FACTORY

MANAGEMENT AND MAINTENANCE

NOVEMBER 1948

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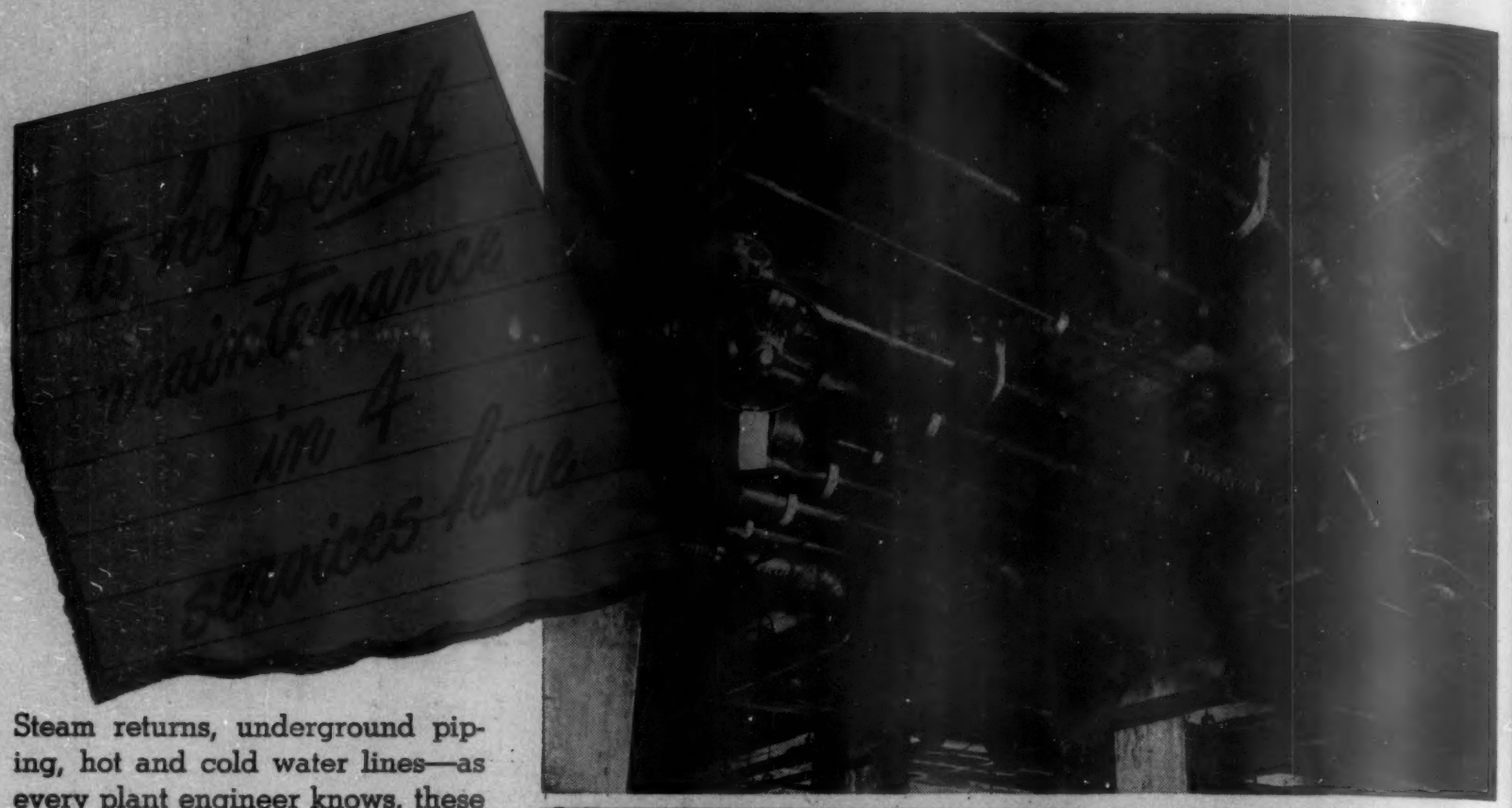
A McGRAW-HILL PUBLICATION

BYERS WROUGHT IRON PIPE



Steam returns, underground piping, hot and cold water lines—as every plant engineer knows, these services face severe corrosion hazards, and only a durable pipe material can protect against early failure and expensive replacement.

In writing the mechanical specifications for an addition to Mercy Hospital, Springfield, Ohio, this maintenance threat was forestalled by extensive use of wrought iron. All the returns, all underground piping except drains, and all hot and cold water lines larger than 2½-inches, were specified "wrought iron." Byers Wrought Iron pipe, in sizes from 3-inch to 8-inch, was utilized. A portion of the installation is shown in the picture. Maguolo & Quick, successors to P. M. O'Meara & Associates were the architects. T. J. Connor Company Inc., handled the plumbing and heating work.

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GENUINE WROUGHT IRON
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FACTORY

MANAGEMENT and MAINTENANCE

NOVEMBER, 1948

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"Give us the tools..."

TO SURVIVE

America Must Have Better Tools

IN THE past twenty years the United States has failed to provide its workers with enough new tools and equipment.

To most Americans this statement will come as a shock—or will be doubted. We are quite complacent about our industrial equipment, for easily understood reasons.

Throughout the '30s we heard continuously the propaganda line that the United States had become a "mature economy." The job of equipping America with industrial plants and tools was said to be largely done.

Now, knowing that industry is spending billions to expand and rebuild its plants, many people assume that the result must be a first-class industrial system.

A further powerful inducement to complacency is the vastly *worse* industrial condition of most of the rest of the world. When Americans look abroad in almost any direction they see shattered plants and equipment. A natural reaction is that we are sitting pretty.

That is a dangerous reaction. Between depression and war, we have failed to build the tools and equipment we need. This condition is dangerous for three reasons:

1. *From bitter experience we know that national security depends first and foremost on the capacity and readiness of our industrial equipment.*

All of our plans for stabilizing prosperity assume a world at peace. The greatest menace to peace would be an unarmed America, unable or unwilling to keep herself strong and ready for defense—strong in spirit, in resources and in the all-important industrial plant and equipment.

2. *Whether Americans live well—or badly—depends directly on the kind and quality of tools used by American workmen.*

This is true for all workers, and for every worker—from a garage mechanic and his wrenches to a steel mill gang and its rolling equipment. In a monumental study of "America's Needs and Resources" the Twentieth Century Fund found this fact: The improvement in the real income of the American people has more consistently followed the amount of power used in industry than anything else. What the workman worked *with* determined, more than any other factor, the size of his pay envelope, and what it would buy.

3. *Our success in stabilizing prosperity will depend largely on what we do about building new tools and equipment.*

About 30% of our industrial workers are employed in producing tools and equipment. Steady employment for them is essential to our over-all prosperity.

How far have we fallen behind in providing new plants and equipment?

Estimates vary. Here is one rough estimate: If we had built new industrial facilities during 1930-48 at the rate we did in the prosperous '20s, we would have spent at least $100 billion more than actually we did.

To get a better and more complete measure of this deficit, McGraw-Hill is undertaking a survey of American Business' Needs for New Plant and Equipment.

Businessmen all over the nation are being asked to answer questions like this: How much

money would you need to put your plant in first class condition? How much are you planning to spend for new plant and equipment? Where do you expect to raise the money? The results will be reported later in this editorial series. Already the survey shows we have fallen many billions of dollars behind.

Some shortcomings are apparent to everyone. They are revealed in a lot of rickety transportation facilities and in rundown buildings.

Many other deficiencies do not come into general view. They are, for example, the antiquated machines in our plants. Of the privately-owned machine tools in use in 1945—when the last census of metalworking equipment was made by AMERICAN MACHINIST—54% were more than 10 years old. Their average age is higher today.

It is true that in recent years we have hit new highs in total national production. But we have done so by putting far more people to work than ever worked before . . . and by driving equipment to the limit of its waning endurance, sometimes beyond. It has not been done *primarily* in what is by all odds the best way to increase production—to use more and better and more modern tools and equipment.

Haven't we overcome much of this twenty-year deficit by rushing to build new plants since the end of the war?

No. For two clear-cut reasons:

1. The accumulated shortage is tremendous. The total of about $40 billion, which has been spent for industrial plant and equipment since VJ-Day, has not wiped it out.

2. Some key industries have had difficulty in getting the facilities they need. Take steel, for example—the industry that turns out our most basic industrial material. Its needs for new equipment are measured in billions of dollars. To pay for that equipment, it should have *risk capital*—money which people are willing to invest with a risk of losing for the sake of gain. For steel is an up-and-down industry. Earnings on its common stocks inevitably share both ways in those ups-and-downs.

Since the war, steel, in common with most of industry, has been unable to market new common stock successfully. Its outstanding stock is now selling for only about one-half the current net worth of the industry's present assets. With investors willing to pay only 50 cents on the dollar for its facilities, the industry can not readily sell stock to pay for *new* plant and equipment—at higher prices even than the old.

Why can't steel—and other industries—attract people who are willing to risk their money retooling America?

The full answer to that serious question must be left to future editorials in this series, for it involves many things . . . tax reform . . . mobilization of small savings . . . a new respect for corporate profits.

This first editorial seeks simply to emphasize two fundamentals:

First, our standard of living improves with the *quality* of our industrial equipment.

Second, American industry and American workmen badly need billions of dollars worth of better equipment *now*.

The American people must understand that *not only our continued prosperity but also our security as a nation depends upon giving American industry more and better equipment.*

"Give us the tools." This was Winston Churchill's cry for help to win the war. Only if we give American industry new and better tools will we have a chance to win abiding prosperity at home and good order abroad.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

★ THIS EDITORIAL, and a series to follow, will be devoted to a single problem—how to provide American industry with the equipment needed to improve that envy of the world, the American standard of living. No more important problem confronts us today. Upon our wisdom in handling it depends not only the degree of our prosperity, but also our security as a nation.

THIS IS THE 69TH OF A SERIES

FACTORY
MANAGEMENT AND MAINTENANCE
L. C. MORROW, EDITOR

WIDER USE OF INCENTIVES IS SERIOUSLY NEEDED

INCENTIVES FOR WORKERS are not new. They have proved their worth over and over. Most of management favors their use to stimulate worker effort. Of the workers who are not paid by incentive methods, four out of five would like to be. Yet far too few workers are paid on an incentive basis. Far too little use is made of this powerful tool of management.

Industry is fortunate, therefore, that every once in a while the management of a plant comes up with new proof of the gains to be had by making it worth while for the worker to work.

What it comes up with may be just straight extra pay for extra work. Or it may be profit sharing. Or guaranteed annual wage. Or payment in proportion to production. All of these terms describe methods of payment that in the end-result provide incentive to work. There are other terms that describe incentive payment and there will be still others as management and workers become more incentive minded.

Some incentives are purely financial, others are non-financial (so-called indirect), and some are both. The variations possible are quite extensive. The evidence indicates that an incentive can be devised to fit almost any job.

Like so many other matters that are of concern to both management and worker, it should be easy for men from both groups to agree upon such a simple thing as how to set a norm and how much to pay for work done in excess of that norm.

Where that has been done, almost invariably unit cost of production has gone down. Both management and workers have benefited. So has the public. The tendency has been strong toward a condition of mutual understanding and satisfactory relationship.

We are at a point in our economy where we should come awake to what can be done by incentives. High labor rates, high prices, high taxes dictate that we do so. And so does the need for manpower to fill defense orders—and war orders, if they come.

Workers Oppose Own Best Interests

It is ridiculous that the leaders of people who work for wages should oppose the very thing that could do much to raise their standard of living. These people are a large part of the public. By their opposition they defeat their own objectives.

Some workers are learning that these things are true. They are learning as and because their communities learn. The communities learn as the public relations work of the companies and corporations within them increases in amount and effectiveness.

Better public relations activities in more units of industry are needed to put us in the way of making full use of this effective tool, which, when properly used, works to everyone's advantage.

L. C. Morrow

STATE TROOPERS stand by to protect workers crossing picket line in front of Bucyrus-Erie's Evansville plant. Strike, which was engineered by union leftists, quickly collapsed. Troopers came in after

How One Union Swept Out

▸ A September article (pages 106-112) told how the Communists move in and take over a union, how management can help the unions fight the Reds . . .

▸ FACTORY now follows up with a timely case study of a company management that would not be coerced, a union membership that cleaned house

LATE IN AUGUST, a leftist hierarchy sat firmly in the driver's seat of the largest union in Evansville, Ind.—Local 813, United Electrical Workers-CIO.

True, the ride was not without bumps. More than 1100 of the union's 7000 members were out on strike against Bucyrus-Erie Company. And the non-Communist opposition appeared to be gaining strength.

On the other hand, the usual Party tactics had been working as well as ever. The strike vote had been railroaded through in fine style, 157 to 8. And al-

mass picketing continued despite Superior Court injunction

ACE WITNESS at hearing was Mrs. Katherine Bell, a former Communist; here, with Congressman Mitchell, she looks over some exhibits

Acme

AVOWED COMMUNIST William Sentner, president of UE District 8, addresses union meeting. He was behind-the-scenes boss of Local 813

the Communists

though the strike was a long way from any settlement pleasing to union officials, their jobs seemed secure.

Then the big wind struck. In three action-packed weeks:

1. The strike was broken and most of the 1100 employees were back at work.

2. Twelve men accused of Communist affiliation were thrown out of five plants *by their fellow-workers.*

3. Top officers (and their administrative staff) were fired or forced to resign, and their memberships in Local 813 revoked.

FACTORY investigated the case shortly after these events took place. On-the-ground observers agreed that no single factor caused the explosion; pressures from several directions had been rising for some time. But they credited a Congressional hearing with igniting the fuse.

Within 48 hours of the close of the hearing, the purge was on. In rapid-fire succession, 12 men in five plants were told by union members to "get out and stay out." Each of the 12 had appeared before the subcommittee of the House Labor and Education Committee. Each had been accused, by one or more witnesses, of having Communist affiliations.

Within a week the two controlling officials of the

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Within a week the two controlling officials of the

union had been voted out of office by the anti-Communists. For the first time in four years, the membership was free to run the organization democratically.

At this point, one might conclude that the Congressional investigators should be given chief credit for cutting the ground from beneath the local's left-wingers. Actually, the campaign against them dates back to 1944. For the first three years, though, the opposition was so feeble, the members were so indifferent, that the top officers could—and did—ignore it.

The real boss of Local 813 was William Sentner, president of UE District 8. Communist since the early 'thirties, he had the complete allegiance of left-wing elements in all locals within his jurisdiction. He set the general policy, the over-all strategy. His machine attended to the details. To be known as a "Sentner man," and to be identified with the leftist bloc, was the sole path to UE power in District 8.

Sentner's strength with rank-and-file members rested on his effectiveness at the bargaining table. His ability to present union arguments and meet those of management won him a wide reputation as a negotiator. After V-J Day, however, the Communist Party grew firmer in its line that labor-management disputes must be prolonged as much as possible. Companies found it increasingly difficult to deal with Sentner. Firms that formerly had reached agreement with UE within a week or two found themselves wrangling twice and three times as long. One Evansville company closed down part of its plant—where Local 813 had jurisdiction—because the only contract Sentner was willing to sign would have boosted the price of the product right out of its market. More than 40 members of Local 813 lost their jobs.

By the time the plant had closed out this division, however, the district president was already deeply embroiled in a controversy with the president of Bucyrus-Erie Company, N. R. Knox.

Studying the main facts available to Sentner, it is difficult to see why he precipitated this battle. Here was the situation when contract negotiations began last April 15:

1. Local 813 could claim as members less than half of the 1100 employees at B-E's Evansville plant.

2. Knox's antipathy toward Communist-dominated unions was well known to Sentner. The previous year, contract negotiations went on for two months, and although, under the Wagner Act, Knox could not fight back, he had been thoroughly fed up.

3. If Knox elected to buck UE—a likely move, under the circumstances—he was in a strong position to do so. B-E has three other plants, covered by contracts with the CIO-Steelworkers. It therefore could stand a prolonged strike in Evansville without seriously affecting production of heavy equipment and road-building machinery elsewhere.

4. The company had drained away much of the employees' desire to strike by offering, at the outset of negotiations, the same terms accepted by Philip Murray for the Steelworkers. A little later, B-E went even further in this direction and gave these terms to Evansville workers, anyway—without consulting the union. The management hammered home the idea that no one B-E plant should pay wages higher—or lower—than those of the other three.

5. Officials of Local 813 had not signed Taft-Hartley affidavits.

An Open Letter to All Workers Pulled No Punches

Negotiations continued for two weeks without Sentner's retreating from his original position—that Evansville employees must have higher wages than the Steelworkers. Then, on May 3, Knox stepped in and wrote an open letter to the district chief. Copies were sent to all 1100 workers. In addressing Sentner, Knox pulled no punches:

"Your real object," the letter stated, "is to confuse our employees by dragging a *red herring* across the trail and hope to cover up the fact that you aren't interested in their welfare but want absolute control over them so you can further your political objective which is the Communist Party line . . .

"We believe if our employees want a union, they want one that represents *them* and not the Communist line. Their leaders should be happy to sign an affidavit that they are not members of the Communist Party . . . I personally would be happy to sign such an affidavit if anyone wanted me to.

"Our Evansville employees have just received the same wage increases we have already put into effect elsewhere, but we want them to know and we herewith advise you that Bucyrus-Erie Company is not in any way interested or willing to enter into an agreement with the UE-CIO or any other union that is led, dominated, or influenced by Communists."

Sentner paused a long time before picking up this gauntlet. For ten weeks things were quiet. Then, on July 27, notices calling for a strike vote were distributed at Bucyrus-Erie. The left-wingers had chosen to fight.

The vast majority of workers ignored the call. Only 165 turned out for the meeting. All but eight were "Sentner men." The latter courageously stood up in meeting and tried to argue against the proposed strike. They were shouted down. The vote: For the strike, 157; against, 8.

Next morning, day-workers discovered the gate was blocked by pickets. Nobody tried to cross the picket line. For nearly four weeks, only office and supervisory personnel were permitted to pass.

The climax came at the end of August. On August 28, a Superior Court order was handed down, temporarily restraining the union from further mass picketing. The following morning, Bucyrus-Erie announced that the plant would reopen August 31, and 40 foremen were dispatched to make the necessary preparations at the factory.

Ignoring the court injunction, more than 100 pickets massed outside the gate and beat off all attempts to gain entry. It was quite a fight. Local authorities wired the governor that the situation could not be controlled with the law enforcement personnel available, and requested a detachment of state police.

By Tuesday, August 31, when the factory reopened, 140 troopers were on hand to guarantee workers peaceful entry. The strike collapsed.

About half of the workers came back that first day. Soon, all but a handful had returned.

MASS PICKETING stops truckload of equipment for Atomic Energy Commission. This led to crisis

The AFL won the bargaining rights at B-E in the NLRB poll which followed a few days later. (The name of Local 813, whose officers had not signed non-Communist affidavits, could not, of course, appear on the ballot.)

What, one may ask, were the non-Communists doing while all this was going on? They were, for the most part, fulfilling their usual role of doormat to the leftist group of union officials.

They suffered from two deficiencies. First, strong leaders with the knowledge of how to battle the leftists effectively. Second, inability to rouse the membership from its lethargy.

Thus the Anti-Communist Committee in Local 813 overlooked the opportunity to fight—with a good chance of winning—in the strike-vote meeting.

The committee did strike one telling blow. After Albert J. Eberhard, the local president, telegraphed Congressman Ed A. Mitchell that 813 opposed the Mundt-Nixon bill, the committee wired Mitchell denying the allegation.

A Congressional Hearing Made Good Listening

The upshot of these conflicting statements was a Congressional investigation of Communist activities in the Evansville area. The hearing opened before a capacity audience. A total of 30 men and women had been subpoenaed; 27 were involved with the UE local, 3 with two units of the United Automobile Workers-CIO.

Only six of these witnesses testified. The other 24 read from prepared statements that they were not refusing to testify but wanted advice from UE International's attorney, then en route from New York.

What the others had to say, however, made vivid listening. Their testimony painted a picture of a well-developed, smooth-functioning Communist bloc in Evansville, which controlled the CIO unions' council there and dominated several labor groups.

The two-day hearing created a sensation in Evansville. Public opinion crystallized as never before.

It was shortly after this that 12 men accused of Communist activity were marched off the job by their fellow-workers.

Six of the 12 voluntarily signed affidavits, that they were no longer Communists, and were reinstated.

It was the workers who saw to this, not the five companies involved. There is, of course, no law banning Communists from private industry—a fact one executive was quick to point out to a delegation of workers who approached him on the subject.

So the men did the job themselves. There have since been charges from the left-wing press that these expulsions were "inspired." As the action was so unusual, this was not strange. But a careful investigation by FACTORY disclosed no hint of evidence that this was true. The workers were sore; they reacted spontaneously against the men who had discredited them in the eyes of the community.

Members of Local 813 were still sore the following Sunday. The anti-Communists jumped in at the beginning of a union meeting and presented a lengthy resolution ordering:

1. Appointment of a special committee to probe the internal and financial affairs of the union.

2. Discharge of two controlling officials and their staff, and revocation of their memberships.

3. Instructions to delegates to the UE District 8 convention, then in progress, to vote against Communist-sponsored proposals, and for (a) CIO policies and (b) executive board members pledged to rid the UE of Communist influence.

4. Revocation of Sentner's honorary membership in Local 813.

5. A vote of "no-confidence" in the local officers and a request that they resign.

A storm of applause, cheers, and stamping of feet greeted this resolution. A counter-resolution was received in silence.

Two hours of stormy debate followed, and there was near riot, according to newsmen, when Sentner said: "I can't sign those affidavits required by the Taft-Hartley law."

When the anti-Communist resolution was finally adopted, 398 to 144, only two of the former officers remained.

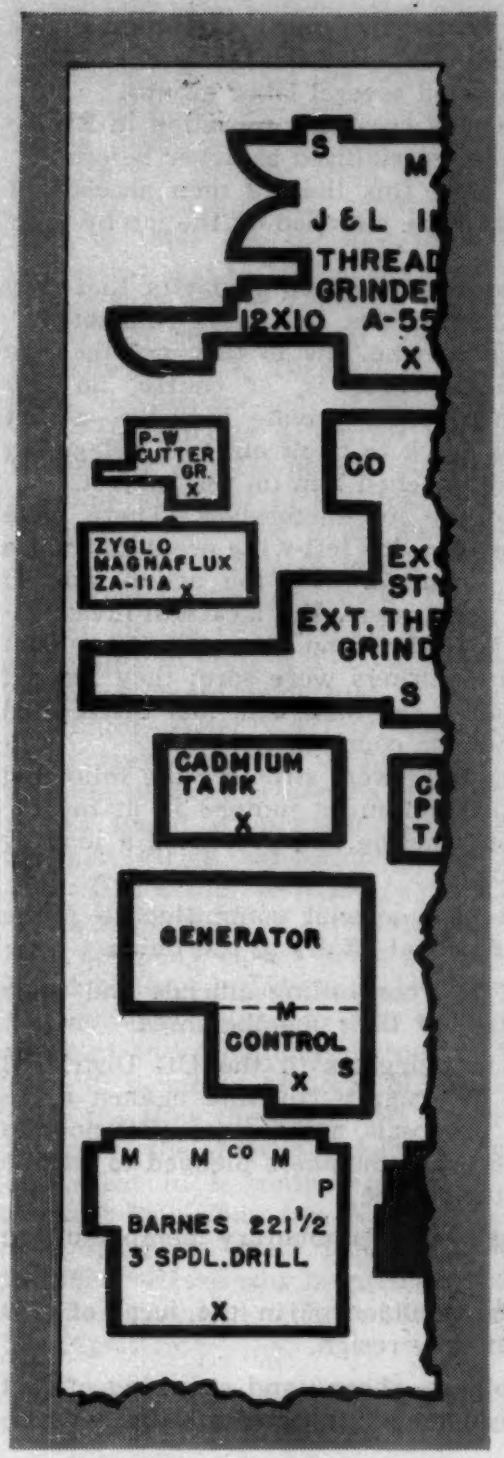
* * *

Whether this will be a permanent victory is still open to question. The road back for Sentner's men will be more difficult—not only because of this experience, but also because the Indiana Council of CIO subsequently voted to ban Communist Party members from CIO unions in the state.

On the other hand, Local 813 delegates, duly recalled and instructed to vote in accordance with the resolution, failed to obey orders. They voted for Sentner's candidates, who won.

So District 8 of the UE, although Sentner will no longer hold office when his present term expires, still will be loyal to him—and to his ideology.

The story starts anew from here. Whether it's part of another book or just a chapter in the old one depends on the membership of Local 813.



PHOTOGRAPHS of drawings, on extra-heavy paper, serve as templets

LAYOUTS are made on drafting boards by tacking templets on "floor-plan" grid which shows where permanent installations are located

PREPARATION OF LAYOUTS

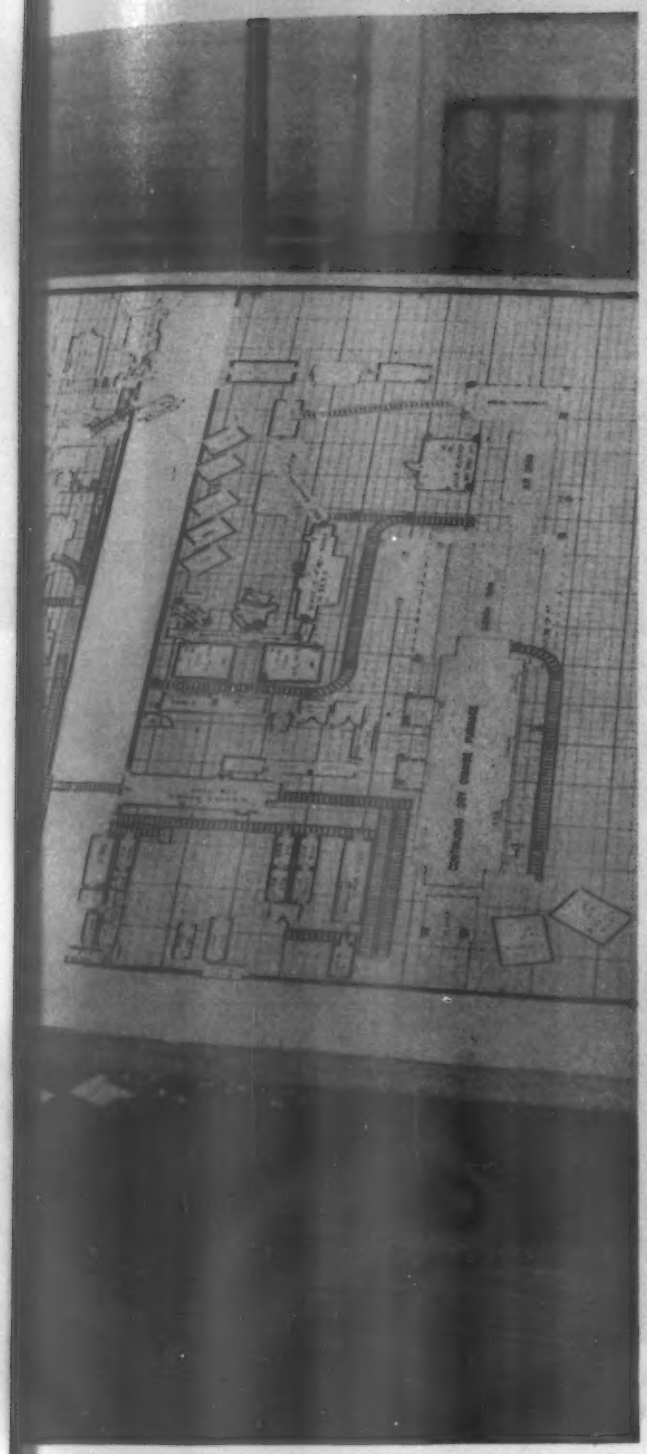
Speed and accuracy in rearranging and copying layouts result from use of the plant's photostat machine

ROBERT E. PARRETT • PROCESS AND PLANT ENGINEER, SAGINAW STEERING GEAR DIVISION, GENERAL MOTORS CORPORATION, SAGINAW, MICH.

PHOTOSTATIC REPRODUCTION of both templet master drawings and plant layouts has resulted in reduced drafting time and increased accuracy at Saginaw Steering Gear Division. Prints of proposed layouts, which used to take hours to prepare, are now produced in a matter of minutes.

Flat-scale replicas of all machines and equipment, including allowance for projections and machine travel, are drawn on a master sheet, which is then photographed. Reproductions are made on extra-heavy paper with a gloss finish, so that they can be handled without too much damage, and also can be easily cleaned. The negative of the master drawing, of course, can be used indefinitely. Thus many hours of hand copying are saved.

And increased accuracy is achieved, because all the templets



Final arrangement is then determined by "trial and error" method

PHOTOSTATING approved layout does not necessitate its removal from drafting board. Copies of original are obtained with blueprint machine

AIDED BY PHOTOSTATING

representing a particular machine or piece of equipment are identical.

Together with top management and representatives of other departments, the layout engineer arranges the templets on a floor plan laid out with grid lines to the scale of ¼ inch equals 1 foot. Every fifth line is drawn in heavily for convenience in measuring 5-ft. intervals. The basic floor plans show the building outline and all obstructions such as columns, downspouts, stairways, and elevators.

Each grid is mounted on a 36x18-in. frame, and represents a section of the plant. When a complete set of these frames is assembled, in the correct position, the entire floor plan of the plant is shown. The basic reason for dividing the layout into sections is for convenience in handling. The engineer can easily remove one frame from the complete layout and place it on his drafting board.

In attaching the templets to the layout board, pins of different colors are used to identify department or operation.

Once the layout is approved, a photostat is made. Any number of copies can then be issued by running the photostat through a blueprint machine.

Much time is saved by the elimination of the older method of redrawing the entire arrangement on tracing paper, and inaccuracies which might occur through scaling errors or mistakes in drawing are prevented.

COMFORT AND CONVENIENCE characterize lecture room at the Stockholm plant of L. M. Ericsson Telephone Company. Seats are of the regular movie theater type. Canvas covered walls are painted light cream

LECTURE ROOM IN SWEDISH PLANT

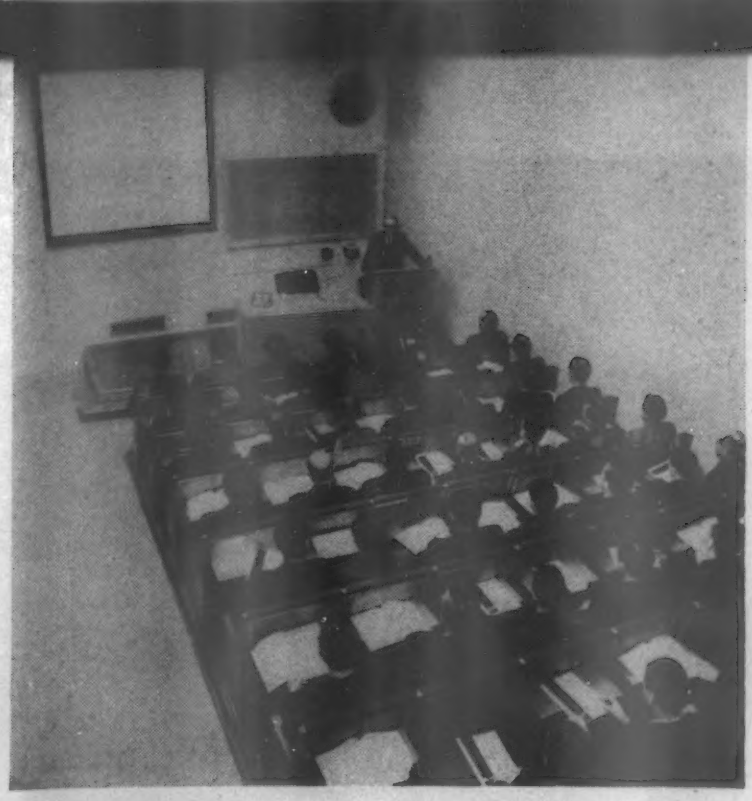
Thoughtful planning and unusual equipment make lecture room a perfect place to hold meetings

THE STOCKHOLM PLANT of L. M. Ericsson Telephone Company has the "last word" in lecture rooms. Its specially designed theater-type room has proved the perfect solution to the problem of where to assemble employees, supervisors, or visitors for almost any type of meeting. And it has an additional use—it is a particularly appropriate place for management to "sell" the attractions of working at "L.M." to groups of promising young engineers still in the student stage.

Ingenious and well-thought-out equipment, rather than architectural magnificence, is what makes this room especially interesting. It is designed for simultaneous use of oral and visual methods of imparting information. When the room is darkened to show films or slides, notes can still be taken by the light of the shaded lamps in the back of the row seats, and the opal glass "blackboard" is lit from behind (chalk marks then show up black). To see what is being shown on the screen, the lecturer needs only to glance in a mirror placed just beside his notes.

Films and slides are shown on twin projectors housed in a raised compartment at the back of the room. Motor-operated screen is raised and lowered from a switch on the lecturer's platform. Sound amplifier is housed behind a round grille above the blackboard.

No special acoustical treatment has been given this room, echoes



"BLACKBOARD" behind lecturer is opal glass, lighted from behind when movies or slides are being shown

BLACK CURTAIN (arrow) is motor-operated, can be drawn to shut out daylight or as a blackout shade

DROP-LEAF SHELVES and lights on back of seats simplify note-taking. Note rack for briefcases

LECTURER'S DESK has a mirror to view screen, switches for signals, two telephones, a lamp, and a clock

HAS EVERY CONVENIENCE

being sufficiently absorbed by the audience, seat upholstery, and pile carpet of the sloping dais on which the seats are placed. Walls are covered with canvas, and painted a light cream shade.

Light that makes possible the taking of notes even when the room is darkened for film-showing is provided by lamps on the back of the row seats. Drop-leaf shelves, also on the back of the seats, are cut away so that the lamps project even when the leaves are closed, allowing the beam to fall on the briefcase rack below.

Wood rather than metal has been used extensively. Wood is pleasanter to the touch, is generally less harsh than metal, and, when properly treated, has a liveliness that metal can never have.

Around the lecturer's stand is a fluted frame—just what any speaker likes to have to hang on to. Pushbuttons and switches are in a panel on the stand for lights, signals to the projector operator, and so on. There are also two telephones. One is connected to the projection booth, the other with the switchboard. A small clock and a lamp complete the equipment.

Over-all lighting is provided by two double rows of incandescent lamps over diffusing glass. Above the lamps is a skylight. Between the skylight and the lamps is a motor-operated black curtain, which can be drawn to shut out the daylight, or used as a blackout shade. The skylight itself is heated by pipes to keep glass free of snow in the winter.

Sixty-three persons can be accommodated in the fixed seats in the lecture room. About two dozen more can be taken care of on chairs of the stackable kind. Stacked up, 20 of these chairs take up no more space than three ordinary ones.

OLD SKYLIGHTING leaked because puttied joints cracked on hot days, and sheet metal ribs rusted

NEW SKYLIGHTING has no ribs to rust. South half is heat-intercepting glass; north half, clear glass

CORRUGATED SKYLIGHTS ASSURE

CARL E. MEYER • BUILDING SUPERINTENDENT, ALLIS-CHALMERS MANUFACTURING COMPANY, MILWAUKEE

NEW SKYLIGHTS ARE HELPING to provide better working conditions in Allis-Chalmers machine shops.

The work of equipping these shops with corrugated wire glass skylights was started about two years ago, and is now nearing completion. For some time before the start of the project, considerable work had been done to determine the advantages of corrugated wire glass compared with other forms. It was found that this type of glass was the best answer to the maintenance problem.

Test specimens of one make of heat-intercepting and clear corrugated glass were found to excel in strength and resistance to impact. In addition, this glass was found to be self-cleaning because faster movement of water as it flowed over corrugations and down "troughs" results in better removal of accumulated dust and soot.

Originally the program called for reglazing an area of some 122,000 square feet and included all but two shops of the general machinery division. Early this year, however, another shop was added to the program, bringing the total area of new glass closer to 140,000 square feet.

The six shops covered by the project are parallel to one another. At the east end of the shops, and at a right angle to them, is the erection building into which all the shops feed. Three of the shops have a high bay with a skylight in the center and contain galleries. Two others have high bays with skylights to the south side over the craneways, and low bays to the north side skylighting the gallery. The sixth shop is a four-story structure and has one skylight.

All the shops are 580 feet long and have ridge-type skylights. Those on four of the shops measure 30x545 feet. On the other two shops the skylight dimensions are respectively 35x545 feet and 32x545 feet, for the high and low bays.

The old skylights were supported at the ridge and curb and at one intermediate purlin. Both halves were made up of 18-in.-wide sheets of flat wire glass approximately 7½ feet long. They were held in place with sheet metal ribs and sealed with putty. On hot days these puttied joints cracked and eventually opened up enough to allow rain to seep in and rust the ribs. Continued rusting permitted water to get under the glass and around the

WATER RUNS FASTER down troughs in new corrugated skylights, does a better job of removing dust and soot. Also, light distribution is far better

BRIGHTER SHOPS

ribs to the inside. Eventually water ran down to the curb where it caused severe rotting of wood members, and more rusting.

No Need for Calking

Leaks were calked, of course, when they became apparent, but this failed to offer any real help in solving the problem, since further puttying merely obstructed the light without really correcting the trouble. The new skylights, on the other hand, preclude all need for eventual calking, since there are no ribs to rust.

They consist of slightly overlapped sheets of corrugated wire glass 2 feet 4 inches wide by 4 feet long which are set on a sealing strip and bolted to the purlin by clips. Heat-intercepting glass forms the south half, while the north half is clear glass. Coved aluminum caps lined with an asphaltic compound cover the joints between the sheets of glass. These caps are bolted to an inner strip, which is also aluminum. The ridge is closed in by means of an aluminum cap resting on a sealing strip and bolted through the joints in the glass, with the bolt also clipped to the purlin. The lower panel of glass is supported in a sealing strip resting on the aluminum curb flashing.

The old skylights had no provision for easy removal of broken glass and insertion of new pieces. Consequently tarred cracks in the glass were numerous. With the new design, if a glass sheet has to be replaced, only the coved aluminum cap need be removed, to insert a new sheet. Through this improvement, tarred cracks appearing in the old glass are completely eliminated, greatly improving the lighting efficiency.

Since each piece of new glass is 10 inches wider than the old ones, it is evident that the area formerly occupied by the sheet metal ribs is greatly reduced, allowing more light to pass through. The new glass also gives better distribution of light, because its corrugated surface produces greater diffusion than is possible with flat glass.

The total cost of the eight-skylight installation, approximately $270,000, is considerably higher than if the job had been done on a newly erected building. The increase in cost can be attributed partly to the extra time spent in changing scaffolding and planking as the work area moved from section to section. In addition, the special care and time required in the handling of steel members, removal and insertion of purlins, and tying of sprinkler lines also caused job labor costs to mount.

Uninterrupted Production

In making the installation, work was done on a 32-ft. or two-bay section of the old skylight. All materials for construction, including glass, purlins, and fittings, were brought up to the roof from the outside and distributed to prevent overloading. A wooden stage was built between trusses spanning the section, to serve as a work platform and keep materials from falling. This procedure enabled the shop to continue operating while work was going on above, and only during periods of change-over from one section to the next was it necessary to discontinue work directly below the stage.

In addition, a schedule was arranged so that change-over periods came on weekends when a minimum of shop work was likely to be going on.

The work area was protected from rain by a canvas curtain battened down with planking, which on cold, windy days also helped to retard heat losses from the building.

Generally speaking, the new skylighting system is an effective morale builder. The cost of the installation, as well as the effort that went into its planning and construction, is far exceeded by the long-term worker benefits it will produce. To appreciate fully the big improvement in lighting requires visual comparison of the old skylight with the new. From an engineering viewpoint, the installation truly represents the progress that has been made by designers through increased knowledge, better methods, and improved materials of construction.

FACTORY'S FIFTH ANNUAL SURVEY
OF WORKER OPINION

SECOND OF THREE PARTS

What the Factory Worker Really Thinks

About Wages, Costs, Prices, Profits, and Strikes

1. He wants his wages to go up and down with the cost of living
2. He has no suggestions on how his company can cut costs without reducing wages
3. He is inclined to think it is enough for a man to turn out an "average" amount of work
4. He is undecided about the government limiting profits
5. He will not strike next year unless living costs rise
6. He no longer expects Taft-Hartley law to cause many strikes

MANAGEMENT HAS FAILED to make clear to the worker that the success of his company depends upon high production and high productivity.

Obviously, the level of productivity depends upon the attitude which the worker brings to his job. In order to influence the worker's attitude, management must know what is on his mind. And what is on his mind changes with the course of events.

In the belief that management wants to keep its policies abreast of changing circumstances, FACTORY presents this survey, which the McGraw-Hill Department of Research certifies as representative of current opinion of non-supervisory workers in the manufacturing industries.

* * *

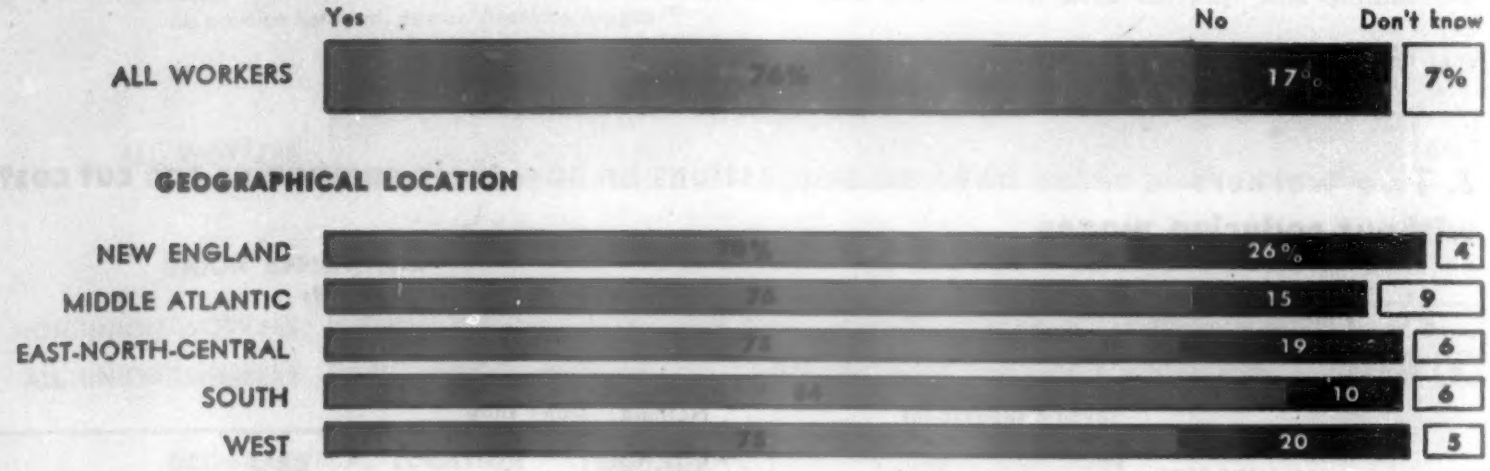
This is the second of three articles based on FACTORY's fifth annual survey of worker opinion. The survey was made for FACTORY by the McGraw-Hill Research Department. Interviews were conducted in 34 states containing 97 per cent of the factory workers in the United States, and were allotted in proportion to geographical concentration of manufacturing workers, type of industry, size of plant, union affiliation (or lack of it), age group, and sex.

* * *

The following geographical designations are used:
New England: Conn., Me., Mass., N. H., R. I., Vt.
Middle Atlantic: N. J., N. Y., Pa.
East-North-Central: Ill., Ind., Mich., Ohio, Wis.
South: Ala., Ark., Del., Fla., Ga., Ky., La., Md., Miss., N. C., Okla., S. C., Tenn., Tex., Va., W. Va.
West: Ariz., Calif., Colo., Iowa, Idaho, Kan., Minn., Mo., Mont., Neb., N. D., N. M., Nev., Ore., S. D., Utah, Wash., Wyo.

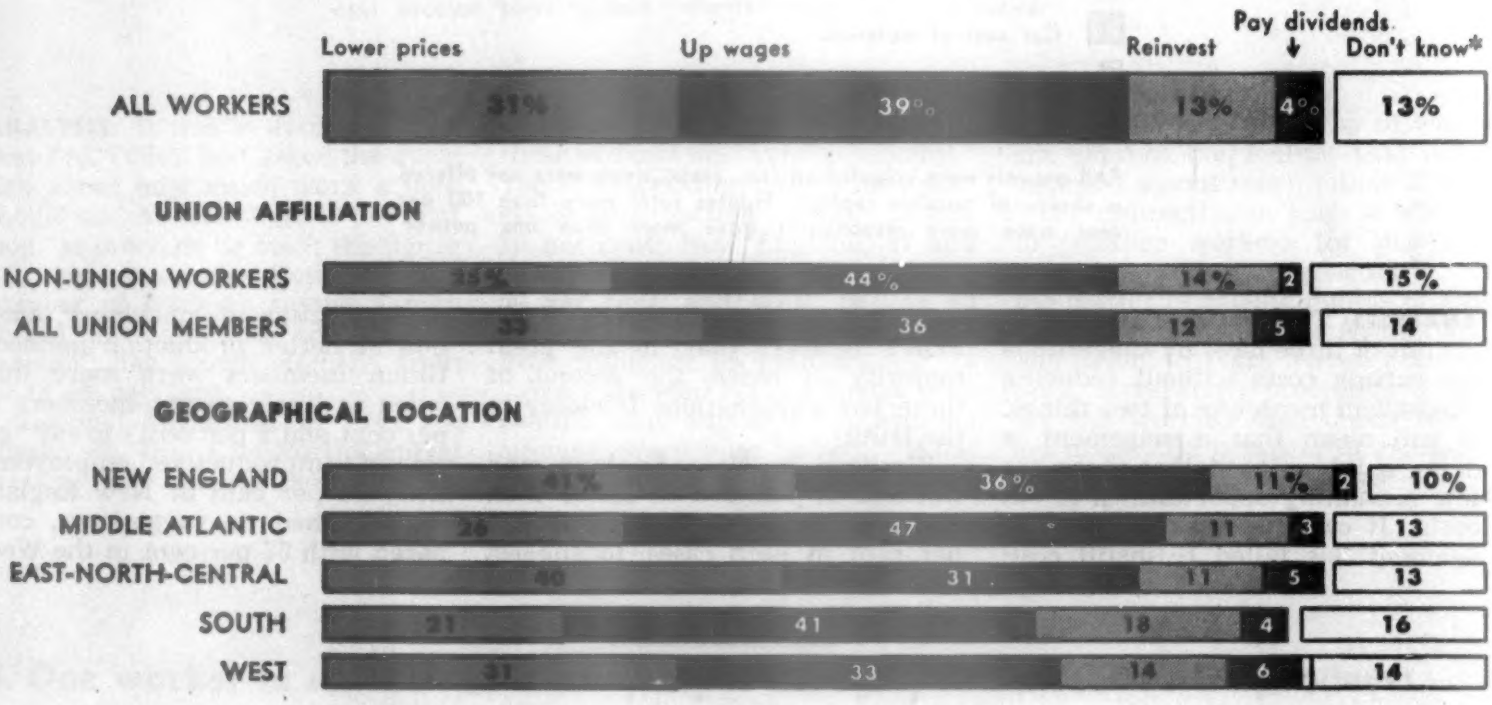
1. Three workers in four want their wages tied to the cost of living . . .

QUESTION: Would you like to have your wages go up and down as the cost of living goes up and down?



. . . but if production costs in their plants are cut, more workers want wages raised than want prices of their companies' products lowered

QUESTION: When a company adopts better methods and better tools, they may cut down their costs. If they do, which should they do first: Lower selling prices, increase wages, put the savings back into the business, or pay more dividends to stockholders?



*Includes 1 or 2 per cent, in each case, of respondents who volunteered replies other than those offered

ANALYSIS: Tying wages to the cost of living is a popular idea among workers. The replies seem to indicate that, so long as management plays fair and raises wages when the cost of living rises, workers would be willing to accept wage cuts when it goes down—and apparently they would not insist on the "floor" provided in the General Motors plan.

When replies are analyzed according to union affiliation (or lack of it), age, and plant size, the percentages of those replying "yes" stay consistently within the range of 73 to 78 per cent. The "no's" vary from 12 to 18 per cent.

Within the several geographical regions, however, there is much greater variation (see above).

On the question of who should benefit first from lower production costs, there is considerable diversity of opinion. That only two workers in five believe wage increases should come first, is a healthy sign. There is a fair degree of recognition, too, that the company and the stockholders must be considered. The variations of opinion by geographical region and by union and non-union may be an indication of the worker's reaction to his current wage level and cost of living.

When FACTORY made a field test of this question prior to the survey (as it does all questions), the workers interviewed were asked to *rate* the four possible answers: Which first, which second, and so forth. Almost without exception, the workers in this test sample insisted upon qualifying their answers in such a variety of

ways that a clean-cut interpretation of the tabulations would not have been possible.

FACTORY stresses the fact that the sample size for this field test was too small to be an adequate indicator, but reports of the test interviewers uniformly called attention to the fact that workers are aware that there must be a division of savings resulting from lower manufacturing costs. No conclusions are justified from the scattered opinions of *how* this division should be made.

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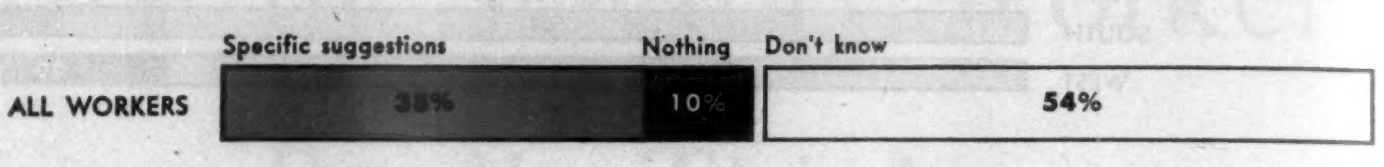
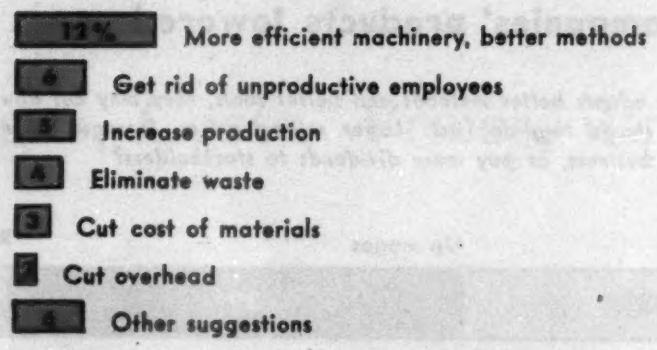
2. Two workers in three have no suggestions on how their companies can cut costs without reducing wages

*QUESTION: What do you think your company can do to lower the cost of making its products without reducing wages?**



NATURE OF SPECIFIC SUGGESTION



*All answers were volunteered (i.e., respondents were not offered a choice of possible replies). Figures total more than 100 per cent since some respondents gave more than one answer

ANALYSIS: The fact that two workers out of three have no suggestions for cutting costs without reducing wages, can mean one of two things. It can mean that management is doing a job so good that there are few remaining opportunities to cut costs. It can also mean that management has failed to instill cost-consciousness in employees. FACTORY believes that, in the great majority of cases, the second of these two explanations is closer to the truth.

Workers in New England and workers in plants with fewer than 100 employees are most likely (17 per cent in each case) to suggest modernization of machinery, adoption of better production methods. Union members were more than twice as likely as non-members (7 per cent and 3 per cent) to say "get rid of unproductive employees." Only 54 per cent of New England workers had no suggestions, compared with 67 per cent in the West.

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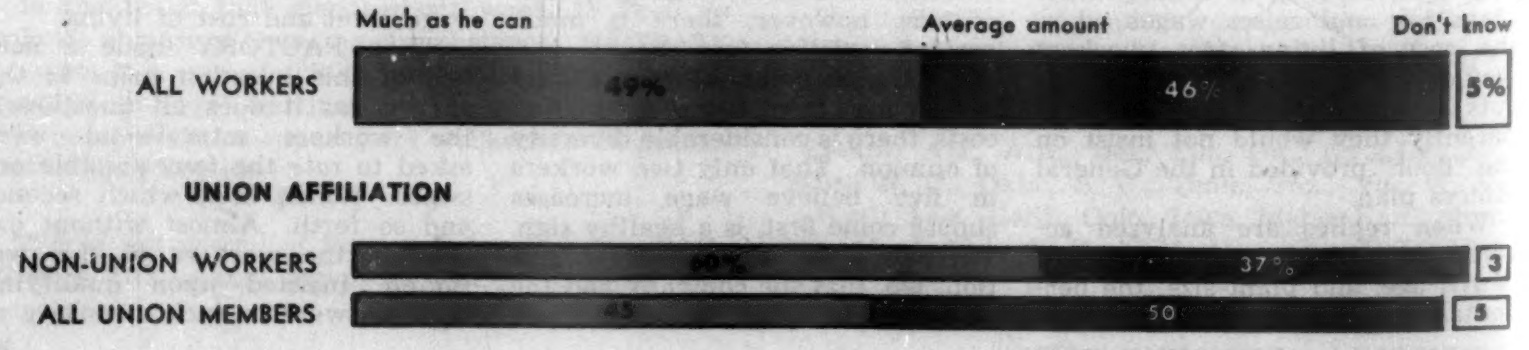
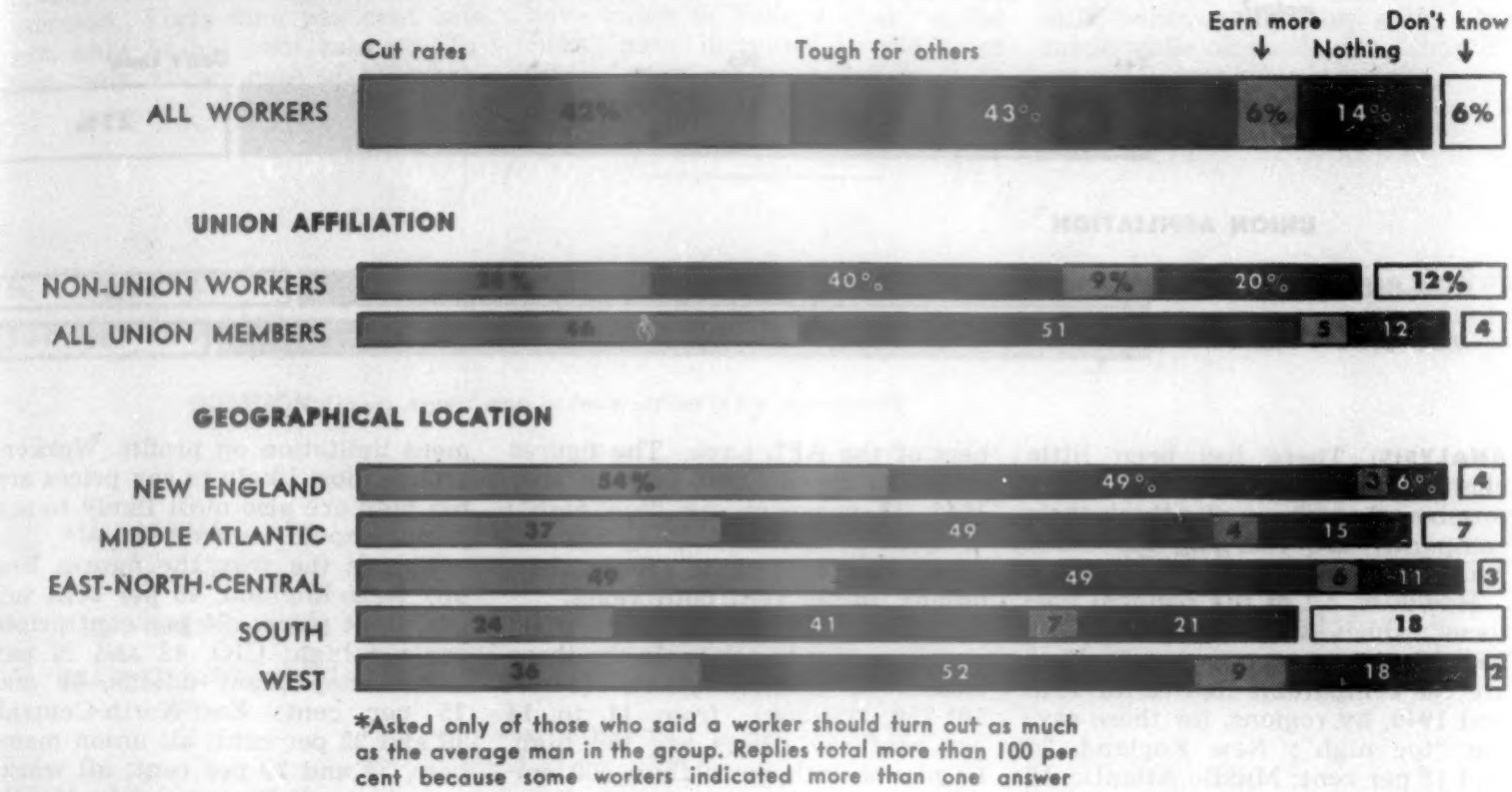
3. Almost half of all workers believe a man should do only an "average" amount of work...

QUESTION: When a man takes a job in a factory, do you think he should turn out as much as he can, or should he turn out as much, say, as the average man in the group?



. . . and predict rate cutting and other disadvantages if anyone does more

*QUESTION: If he turned out more than the average, would management raise quotas or cut rates, would things be made tough for other workers, would he earn more money and have his position bettered, or would nothing happen?**



*Asked only of those who said a worker should turn out as much as the average man in the group. Replies total more than 100 per cent because some workers indicated more than one answer

ANALYSIS: It was in January, 1946, that FACTORY first asked the question about how much work a man should do. At that time, 49 per cent said "as much as he can"; the figure has not changed. However, the number of workers saying a man should turn out only an "average amount" has grown slightly, from 40 to 46 per cent.

Regional variations in 1948 are sharp. In the East-North-Central section, only 34 per cent say "as much as he can"; 60 per cent of these workers say "average amount." The corresponding figures for workers in other sections: South, 65 and 30 per cent; New England, 47 and 49 per cent; Middle Atlantic, 52 and 54 per cent; and West, 56 and 42 per cent. Age and plant size have little influence on opinions.

Workers who replied that a man should turn out only an average amount were also asked, "What would happen if he turned out more?" A heavy majority of workers express the feeling that management would react, either directly or indirectly, in such a way as to penalize workers for this better performance. Particularly on the matter of raising quotas or cutting rates, it is worth noting that non-union workers (who, presumably, have less "protection") are far less worried than union workers about the prospect of management making such changes.

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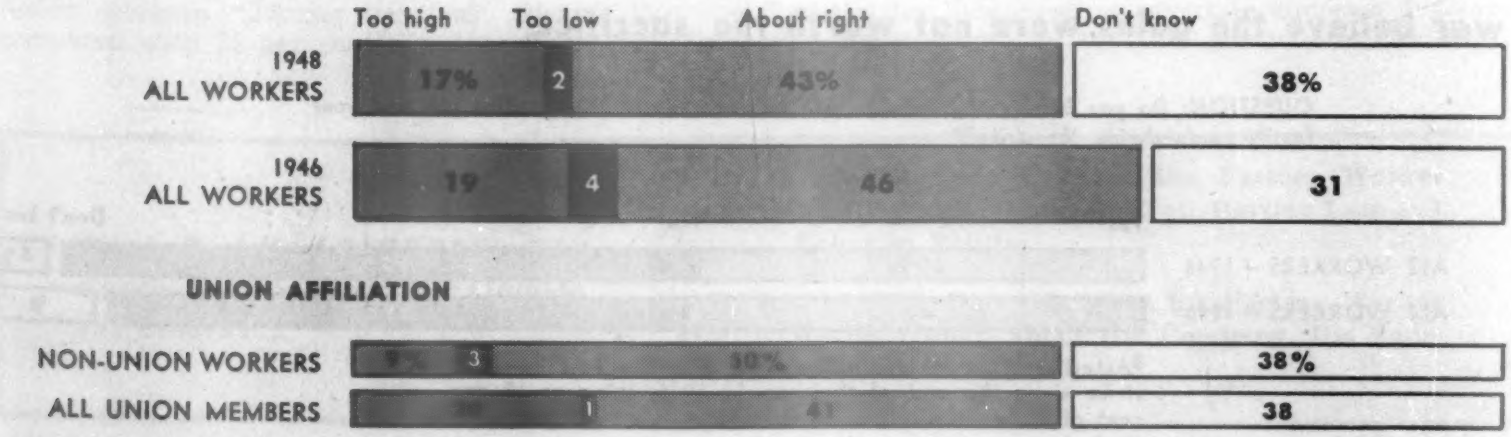
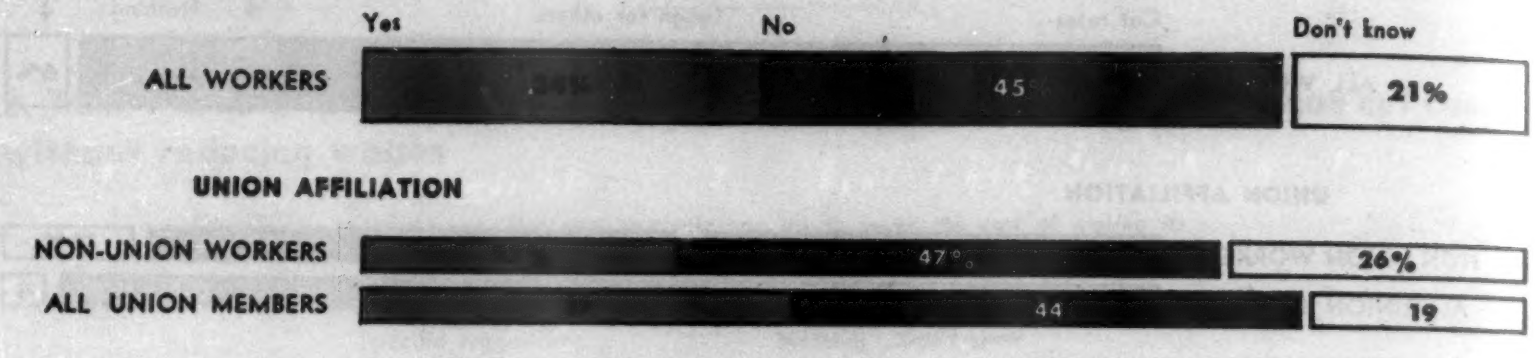
4. One worker in six thinks his company is charging too much for its products . . .

QUESTION: Do you think that the prices your company charges for its products are too high, too low, or about right?



. . . and two workers in six believe the government should place a limit on the profits their companies make

QUESTION: Do you think the government should place a limit on the profits your company makes?



ANALYSIS: There has been little change since November, 1946, in the number of workers who think their companies are charging too much for their products.

However, all of the regional patterns, which were strong in 1946, have been completely upset. Here are the comparable figures for 1948 and 1946, by regions, for those saying "too high": New England, 24 and 13 per cent; Middle Atlantic, 15 and 24 per cent; East-North-Central, 22 and 15 per cent; South, 7 and 16 per cent; and West, 15 and 22 per cent, respectively.

Members of CIO and of independent unions have shown no appreciable change in opinion about company prices since 1946; members of the AFL have. The figures for AFL in the two periods are: 1948, 13 per cent say "too high"; 1946, 20 per cent. CIO figures are 25 and 23 per cent; in independent unions, 15 per cent both years.

Size of plant also has an effect upon reaction to prices. In the three classes of smaller plants (1-100, 101-250, 251-500), from 11 to 14 per cent say prices are too high. In plants with more than 500 employees, 22 per cent say so. Comparable figures are not available for 1946. Age of the worker has no significant influence.

Almost without exception, there is a direct relationship between the feeling expressed on prices, and the sentiment regarding a government limitation on profits. Worker-groups most likely to say prices are too high are also most likely to say profits should be limited.

This is the way the figures line up: New England, 46 per cent say *yes*, limit prices, 24 per cent prices are too high; CIO, 42 and 25 per cent; independent unions, 40 and 15 per cent; East-North-Central, 38 and 22 per cent; all union members, 37 and 20 per cent; all workers, 34 and 17 per cent; Middle Atlantic, 36 and 15 per cent; AFL, 28 and 13 per cent; West, 27 and 15 per cent; non-union workers, 27 and 9 per cent; and South, 24 and 7 per cent. The pattern, however, does not hold with regard to worker-groups in the various plant sizes.

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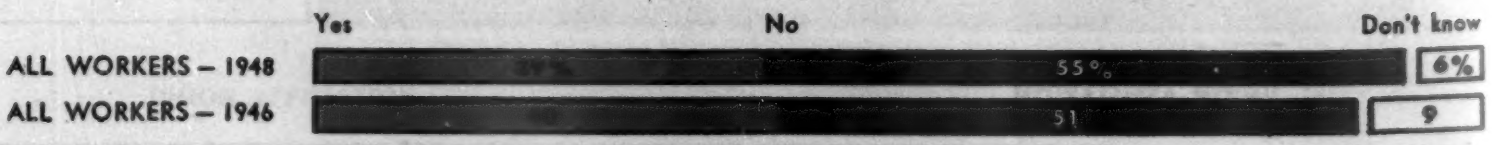
5. One worker in five is prepared to strike for a wage increase next year unless the cost of living drops . . .

QUESTION: Assuming that the cost of living is no higher next year than it is now, would you, personally, be willing to go on strike next year to get a wage increase?

. . . even though most workers who have been out on strike since the end of the war believe the gains were not worth the sacrifice

*QUESTION: Do you believe the benefits you got were worth the sacrifice you and your family made during the strike?**



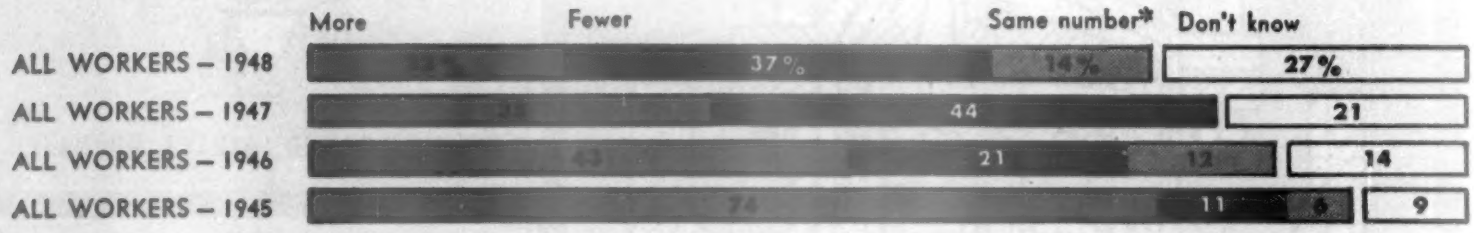
*Asked only of those workers who said they had been on strike since the end of the war. In 1946, this was 19 per cent of all workers interviewed; in 1948, it was 20 per cent

ANALYSIS: Two years ago, FACTORY asked those workers who said their companies could afford wage increases without raising prices (80 per cent of all workers) if they would vote to strike for an increase. Forty-nine per cent said *yes*, only 34 per cent said *no*. Today, only 21 per cent of all workers say that they will strike for an increase next year *assuming the cost of living is no higher than it is now.*

Management would be mistaken to conclude from this that workers have come to believe that "strike risks" have increased to the point where they act as a deterrent to striking. The percentage of workers *who have been on strike*, and who believe the gains were not worth the sacrifices, has increased only slightly (50 to 55 per cent) since 1946. Two workers in five still believe that the gains they made while on strike more than offset the losses they sustained.

6. The percentage of workers expecting more strikes in the year ahead has fallen for the fourth successive year...

QUESTION: Do you expect more or fewer strikes in the year ahead?



*This reply was volunteered (i.e., not offered as a possible choice by interviewer)

. . . and workers no longer expect the Taft-Hartley law to be a leading cause of strikes

*QUESTION: What do you think will be the chief causes of strikes in the year ahead?**

*All answers to this question were volunteered (i.e., respondents were not offered a choice of possible replies)

ANALYSIS: Here is additional evidence (see Question 5, first part) that there will be continued improvement in the strike picture through 1949. A majority of workers predict that there will be fewer or the same number of strikes. And fewer workers (22 per cent as compared with 35 per cent a year ago) predict more strikes in the year ahead. (To date, workers' predictions have been correct three times out of three.)

Workers apparently recognize that a year ago their union leaders sold them a bill of goods in predicting that the Taft-Hartley law would be responsible for a great wave of strikes. Only 3 per cent of workers (4 per cent of union members) now see the Taft-Hartley law as a leading cause of strikes in the year ahead. With the labor law eliminated as a factor, predictions by workers of strike causes revert to almost a duplicate of the 1946 predictions (for 1947).

This is Part II of FACTORY's Fifth Annual Survey of Worker Opinion. The others . . .

IN OCTOBER, Part I. What the Factory Worker Really Thinks About the Taft-Hartley Law and Labor in Politics

IN DECEMBER. Part III. What the Factory Worker Really Thinks About His Company, His Foreman, and His Union

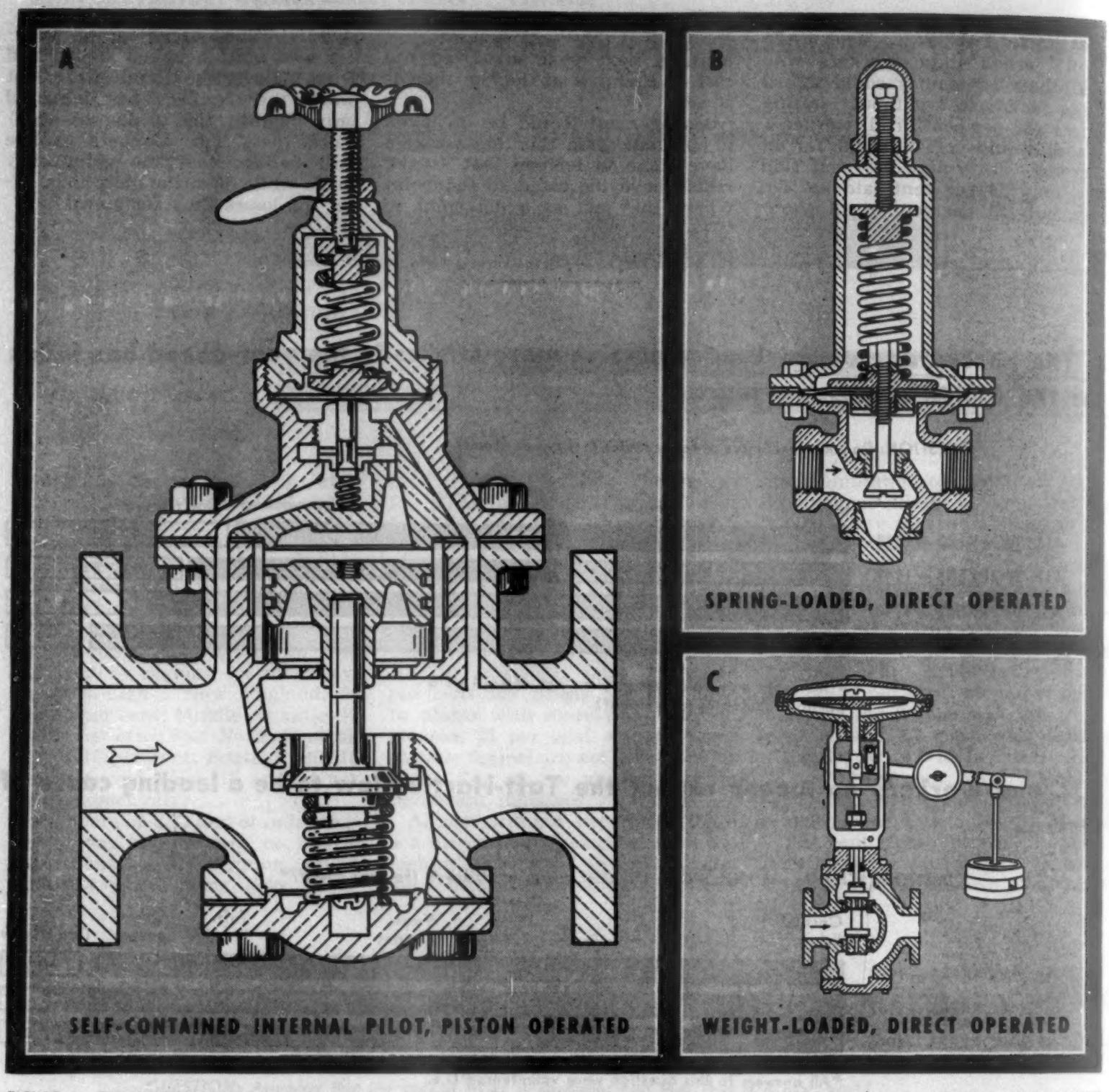


FIGURE 1. THREE PRESSURE REDUCING VALVES. FOURTH TYPE, DIAPHRAGM-OPERATED, IS SIMILAR TO *A*, HAS EXTERNAL STEAM PILOT

PRESSURE REDUCING VALVES . . .

JOHN S. LESLIE • PRESIDENT, LESLIE CO., LYNDHURST, N. J.

HARDLY AN INDUSTRIAL PLANT EXISTS that does not use pressure reducing valves. Their use is so common that they are often overlooked from the standpoint of preventive maintenance. Once installed, a valve is too often forgotten, unless trouble arises. And when that happens, it usually means costly downtime for a machine, a department, or even an entire plant.

Properly selected and installed, pressure reducing valves can be expected to give reliable service for a great many years at low maintenance expense.

Trouble with valves can generally be traced to improper engineering in selection, installation, operation, or maintenance. Despite manufacturers' precautions to supply complete information, there are numerous cases where the wrong valve has been ordered, or a valve has been improperly operated or inadequately maintained.

In other words, there appears to be a need for a better understanding by plant engineers, and particularly operating and maintenance men, of the functions and limita-

FLUID	PRESSURE P.S.I. (GAGE)	SERVICE	VELOCITIES — F.P.M.
Saturated Steam	0-15	Heating Mains	4000-6000
Saturated Steam	50-up	Miscellaneous	6000-8000
Superheated Steam	200-up	Turbine and Boiler Leads	10000-15000

PIPE SIZE (INCHES)	PRESSURE P.S.I. (GAGE)											
	5	25	50	75	100	150	200	250	300	400	500	600
½	30	55	90	120	150	210	270	330	390	495	660	740
¾	55	100	160	220	280	390	510	620	730	930	1150	1390
1	90	170	270	390	460	650	840	1020	1200	1530	1900	2280
1¼	160	300	480	650	820	1150	1490	1830	2160	2760	3410	4100
1½	220	470	660	900	1100	1600	2060	2550	3000	3820	4750	5700
2	370	700	1100	1500	1900	2680	3450	4200	4980	6350	7900	9450
2½	525	1000	1600	2175	2750	3950	4950	6050	7150	9120	11300	13600
3	800	1600	2500	3350	4250	6000	7700	9450	11200	14200	17700	21300
3½	1100	2100	3400	4550	5700	8050	10200	12700	15000	19100	23700	28500
4	1450	2750	4300	5850	7400	10450	13450	16400	19200	24400	30400	36500
5	2300	4400	6800	9300	11700	16500	21200	26000	30800	39300	48800	58500
6	3200	6200	9800	13200	16800	23700	30800	36900	44000	56000	69700	83500
8	5700	10800	17100	23300	29300	41300	53100	65200	76800	98000	121000	145500
10	9300	17800	28100	38000	48100	67500	87100	106500	126000	160000	200000	240000
12	13500	25800	40700	55300	69700	98500	126500	154700	183100	233000	290000	347000

TABLES above are helpful in determining maximum amount of steam flow which a given pressure reducing valve should be required to handle under specified conditions of service, pipe size, and pressure

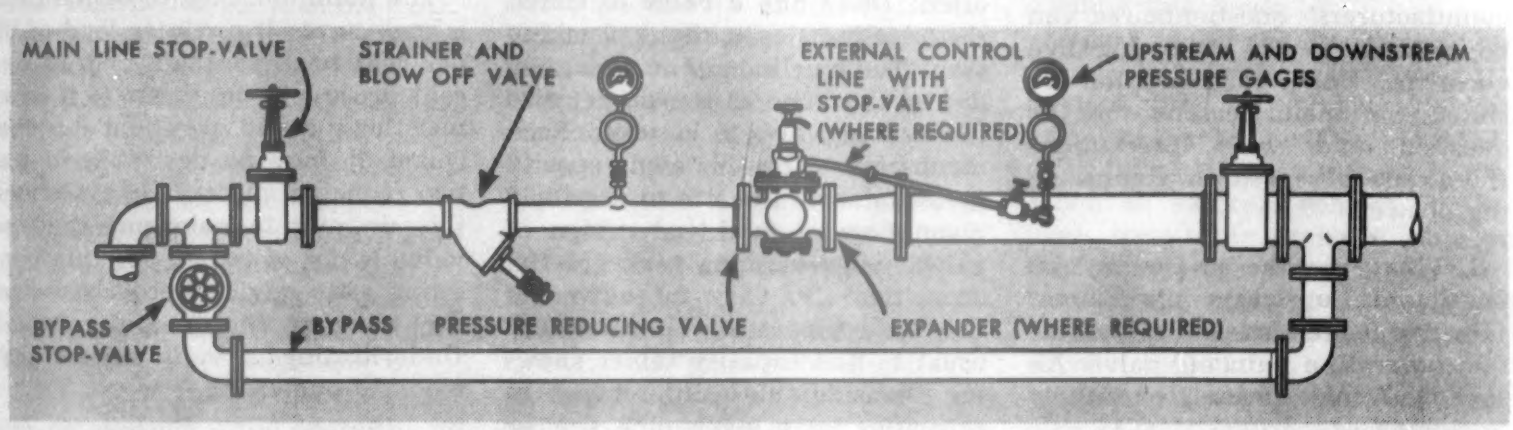


FIGURE 2. TYPICAL INSTALLATION OF PRESSURE REDUCING VALVE, ACCORDING TO GOOD PRACTICE, INCLUDES EIGHT ELEMENTS SHOWN ABOVE

HOW TO SELECT AND INSTALL THEM

tions of pressure reducing valves. To that end this article is dedicated.

DEFINITION

A pressure reducing valve is an automatic regulating valve for controlling the downstream pressure of a fluid from a higher-pressure source. The fluid may be a liquid (water, oil, gasoline) or a gas (steam, air, oxygen). There are three general types of pressure reducing valves: (1) Self-contained internal pilot-operated (Figure 1a); (2) self-contained external pilot-operated (not shown, but similar to Figure 1a in design); and (3) spring- or weight-loaded direct-operated, with diaphragm, bellows, or piston (Figures 1b and 1c). A "self-contained" or "self-operated" valve is one that uses the fluid being controlled to operate the main valve.

Not included in this article are instrument-operated or external-pilot-operated controllers using diaphragm regulating valves and an auxiliary operating medium, such as air, water, oil, electric motor, or solenoid, because these types are not generally referred to as reducing valves. In such regulating valves the power used to actuate the main valve is taken from a source other than the fluid being controlled.

Most of the common industrial applications of pressure reducing

valves are in steam, air, and water lines. The principles included, however, apply equally well to other fluids of similar nature.

SELECTION

Pressure reducing valves should not be purchased like pipe fittings. The determination of the best valve for the job depends upon the specific application and service intended. Because there are so many factors involved, each manufacturer prefers to be consulted as to the best and most economical type to use.

In most instances, the manufacturer presents a questionnaire which often is not considered as seriously as it should be. Careful effort by the plant engineer to give correct answers to this questionnaire determines to a large extent the successful application and operation of the valve. Misleading or incorrect answers might spell trouble for which the valve is blamed rather than its misapplication. Pressure reducing valves are rugged, but can never overcome the handicap of loosely drawn engineering specifications.

In general, the content of all manufacturers' questionnaires can be reduced to the following five questions. Under each question are stated the main reasons for the question and what precautions should be observed in composing the answer:

1. What are the minimum and maximum upstream pressures? (Upstream pressure is the pressure that enters the reducing valve. Also called inlet, initial, or supply pressure.)

Construction and body materials (whether bronze, iron, or steel) are usually dependent on the upstream pressure.

Upstream pressure must not be guessed. If possible, measure it by a gage at the inlet of the pressure reducing valve under maximum flow conditions. A common mistake is to use boiler pressure without consideration of intervening pipeline losses. In this there is danger of "undersizing" the valve if the actual upstream pressure is lower than reported. If the pressure at the valve inlet cannot be measured, pipeline losses from the boiler or the nearest pressure gage should be calculated carefully and deducted from the gage reading.

With steam, the maximum amount of superheat, if any, also must be known because of its effect on the choice of material, and for determination of valve capacity.

2. What downstream pressure is to be maintained, or what adjustable range of reduced pressure is desired? (Downstream pressure is the pressure discharged from the valve. Also called outlet or reduced pressure.)

The value of this pressure is determined by the problem or process and usually involves no guesswork. From it a manufacturer determines the size of diaphragm and spring or other loading device (such as weight). If the downstream pressure is fixed, the pressure differential established by the minimum upstream pressure can be used to size the valve accordingly. If an adjustable downstream pressure is required, then the valve must be sized according to the minimum pressure differential available.

3. What minimum, maximum, and average flows of fluid are to be handled by the pressure reducing valves?

Although presumably well known, the rule cannot be repeated too often: *Don't buy a valve to match the pipeline size without checking flow.* The pipeline size may or may not be the same as the proper size of reducing valve to be used. Each manufacturer has his own capacity tables to show the size to use for a given flow of fluid and design of valve. Since designs vary greatly, capacities also vary for valves of the same pipe size. It is not unusual to find capacity tables showing considerable differences in capacities for a given pipe size, or differences in sizes for a given capacity. That is why it is important to know the amount of flow.

When reducing to 25 per cent of the inlet pressure, or less, steam expands in volume two and one-half to five times. Yet the proper valve size may often approximate one-half that of the outlet piping. If the flow is unknown, it can be readily determined by the use of a flowmeter, or estimated on the basis of equipment performance.

For steam service, the size of the existing outlet piping (provided it is satisfactorily handling the load) is an important guide. Using generally accepted reasonable steam velocities shown in the tables on page 83 and this outlet pipe size, an estimate of maximum steam flow can be made.

The lower table shows steam capacities of extra-strong wrought iron or steel pipe in pounds of steam per hour at a velocity of 6000 f.p.m. Where a velocity greater than 6000 f.p.m. is expected or permissible, figures are adjusted by a factor. For example, multiplying these figures by 1.5 indicates capacities at 9000 f.p.m. velocity.

As an example of the application of this table, assume there is a 3-in. process main to which it is desired to supply steam at a pressure of 50 p.s.i. at an allowable estimated maximum velocity of 8000 f.p.m. For this downstream pressure the table shows 2500 pounds per hour at 6000 f.p.m. Using a factor of 1.33, we obtain a flow of 3333 pounds per hour at 8000 f.p.m.

In specifying the maximum flow there is a tendency to allow for an expected increase in load. It is unwise to allow more than 25 per cent over actual requirements because oversizing the reducing valve may lead to difficulties in operating in the nearly closed position most of the time. Among these are unstable regulation, chattering, breakage of diaphragms, wire drawing of seats, and excessive wear.

The minimum flow to be handled is important. If a winter load of 90 per cent heating steam and 10 per cent process steam drops to a summer load of 10 per cent process steam, it may be desirable to use two reducing valves. Always check the minimum to make sure that the valve is not oversized for this condition after having been chosen on the basis of the maximum load. Underloading a valve is synonymous to oversizing.

4. Is "dead-end" shutoff required?

A dead-end valve is one that closes tight, preventing flow of the fluid to the downstream side. This is a frequent requirement in main headers supplying steam to heating systems. If the valve does not close tight when steam is not required, it will permit the downstream pressure to build up to line pressure, or to a point where it will blow the downstream safety valve or damage the piping.

A simple rule is: *Don't use a double-seat reducing valve if a tight shutoff is wanted.* Only single-seat valves satisfy this requirement.

5. What kind of connections are required, screwed or flanged?

The answer is determined by good piping practice and the actual conditions of installation. For the

smaller pipe where screwed fittings are used, unions on both sides of the reducing valve are generally recommended.

INSTALLATION

A basic rule in the installation of any piece of mechanical equipment applies equally well to pressure reducing valves: *Check and follow the manufacturer's recommendations.* Besides including such information in their catalogs, most manufacturers furnish an instruction sheet or tag with an installation sketch for each valve shipped.

Despite these precautions, it is surprising how many trouble calls can be traced to failure to follow the manufacturer's recommendations. For instance, a valve is sometimes installed backward, despite an arrow on the valve body showing flow direction.

In valves where an external control pipe is required, it is sometimes omitted. Experienced pipefitters have removed the control line "dirt" plug with its telltale hole and replaced it with a solid plug, instead of installing the control piping. The fault for these foolish errors sometimes lies in the removal of the instruction cards in the stockroom instead of leaving them on the valve for the pipefitter.

Good installation practice always includes a bypass to permit emergency repair or maintenance without shutting off the supply. An example of this is shown in Figure 2. When a reducing valve with an external control pipe extending outside the bypass is used, be sure to include a stop valve and union in that control line so that the steam may be shut off while operating on the bypass and servicing the valve.

Do not locate the reducing valve in an inaccessible spot, difficult to service or maintain. In one case, a reducing valve was so surrounded by steam pipes that the whole steam system of the plant had to be shut down to take the valve out of the line.

Dirt entering a reducing valve may damage or score the internal parts, resulting in leaks across the seat or in the sticking of moving parts. This means excessive cleaning and maintenance.

Since a certain amount of dirt and scale is present in pipelines, it is advisable to install a strainer ahead of the reducing valve. A Y-type strainer with a blowoff valve simplifies the job of periodic cleaning. When a strainer is located ahead of the bypass, it also protects all stop valves.

Use pipe compound for threaded joints only sparingly. Be careful not to get it into the piping system where it may cause the internal parts of a reducing valve to stick. When this happens, the valve must be taken apart and cleaned.

The question often arises when and how to expand the outlet pipe after a reducing valve. The answer depends on the difference in specific volume between the upstream and downstream pressures, and the velocities permitted in these two systems. A good rule-of-thumb to follow when handling steam, air, or gas is to expand the outlet pipe to no more than twice the size of the reducing valve when the reduced pressure is 25 per cent or less of the upstream pressure. Since liquids are not compressible, piping is generally not expanded after reducing valves for this service.

Taper Expanders

When an expansion is made, taper expanders are preferable to reducing bushings to reduce turbulence and noise which often result from sudden expansion from one pipe size to another. In the larger flanged sizes, the length of the taper expander should be not less than three to five times the pipe diameter of the smaller end. Where high velocities caused by high pressure drops are involved, this rule should be observed even to the extent of ordering a special pipe fitting.

Where required, an external control or feeler pipe to the diaphragm of the reducing valve should be connected into the outlet pipe at a distance of 3 to 5 feet from the outlet of the reducing valve. Connection of the control pipe to a line which is more than twice the nominal size of the reducing valve may result in "hunting" or "cycling." Hunting is overregulation caused by an excessive variation of reduced pressure, because of the time lag between the diaphragm and point at which the impulse is taken. If additional expansion is needed beyond the limits just specified, to reduce velocity and increase capacity of the outlet system, it can be made in one or more steps beyond the control-pipe connection without affecting the regulation.

A few years ago it was common practice for the manufacturer to furnish reducing valves with bodies having expanded outlets. In the interest of standardization, this practice has been discontinued by the majority of manufacturers. Equally good results are justifying the use of standard bodies and taper expanders at the outlet at a lower installation cost.

In steam lines, always install reducing valves at a relatively high point rather than in pockets where condensate and dirt may collect either when the valve is closed or during periods of shutdown. Excessive water or condensate will usually be harmful and cause excessive wear. In some cases it may cause erratic action and poor regulation. The use of a steam trap ahead of a reducing valve, when it is installed at a remote point from the boiler, will prove worth while.

Use a Pressure Gage

Although of obvious utility, the use of pressure gages before and after a reducing valve for setting and checking is frequently overlooked. Almost as bad is the attempt to set a reducing valve from readings of a downstream gage located some distance away. The valve may be blamed for poor performance actually caused by intermediate line losses.

Where a self-contained reducing valve with an internal control port is used, the downstream pressure gage should be installed immediately following the reducing valve. When an external control pipe is used, install the pressure gage in this control pipe so that it will indicate the true pressure acting on the diaphragm to which the reducing valve is responding.

In many cases an upstream pressure gage is omitted because it is felt unnecessary. However, when other lines are later added to the system ahead of the reducing valve, and heavy flows occur, a pressure drop may develop which results in a lower inlet pressure than that for which the valve was intended. This will result in a reduction in capacity, and also may affect the reduced pressure. If a pressure gage is not installed at the inlet side, it is usually very difficult to observe this action and to realize it is caused by the drop in pressure. Consequently, the reducing valve is blamed, and much time is wasted finding the reason for its seeming failure. So, if you can afford it, always install an upstream pressure gage.

When installing a pressure reducing valve in a new pipeline, if pos-

sible first blow out the line thoroughly to remove dirt, scale, and other foreign elements. In this respect, industry should take a tip from the marine field, where this is accepted practice.

Two questions are most frequently asked in connection with installation of pressure reducing valves:

A. Does the low-pressure side of a system require a relief valve?

The answer is, *yes*, and *no*. Where the low-pressure system will stand the full upstream pressure without danger of failure in event the valve does not close tight, a safety valve is not essential. A small safety valve, however, will serve as an indication of reducing valve failure, although it might not have full discharge capacity of the system. Where the low-pressure system must be protected against excessive pressure for safety reasons, a safety valve having the same capacity as the reducing valve should be installed. Also, provision should be made for escaping steam according to local conditions and ordinances.

B. Can a pressure reducing valve be installed upside down?

It is best to install an internal pilot-operated valve upright or within 45 degrees of the vertical. This keeps water and dirt out of the pilot mechanism.

On the other hand, in a direct-operated spring- or weight-loaded reducing valve in a steam line, the diaphragm should be on the bottom, despite most sketches and photographs to the contrary. This position provides a water seal which protects the diaphragm from live steam contact.

OPERATION

There are only a few basic rules to remember in the operation of pressure reducing valves, but they are important from several angles.

When placing a reducing valve into service, check the position (whether open or closed) of all stop valves connected with that particular installation. Don't fail to open the strainer blowoff valve before cutting in the reducing valve, to get rid of condensate and dirt that may have collected in the system. In a steam line, slugs of water or condensate are dangerous and may create shocks that will be harmful to the working parts, and also may cause serious leaks in the pipe and fittings.

When cutting a reducing valve into service, it is best to "crack" the downstream stop valve and then gradually open the upstream stop valve before setting the reducing valve. As this is done, watch the downstream pressure gage for excessive pressure which might overheat or overstress the equipment. If excessive pressure occurs, it can be readily controlled with the upstream stop valve.

Don't readjust or overset a reducing valve while filling the piping system. Some people think that, because they do not immediately get downstream pressure with both stop valves wide open, the reducing valve is not wide open. This is not so—the valve, when functioning properly, is actually wide open. When a low-pressure system is cold, a reasonable time is required to bring it up to pressure, during which time the reducing valve will be wide open until the desired pressure is reached.

If a reducing valve has been previously set, it should "take hold" and maintain the set pressure as the upstream stop valve is opened wide. The final adjustment now can be made on the reducing valve with the downstream stop valve still only cracked open. Then as this valve is opened wide, the pressure on the downstream gage drops because of the heavy flow while the low-pressure system is being filled. When the pressure builds up to the previously set point, the valve throttles and maintains the pressure at a setting proportional to the flow at that time, based on its accuracy of regulation characteristics.

Before leaving a new installation, be sure all stop valves are fully open and bypass valves are tightly shut. A leaky valve in the bypass will give the impression that the reducing valve is leaking. Sometimes the operator forgets to open the stop valve in the control line and wonders why the reducing valve doesn't function.

Every Month . . .

AMONG THE ADVERTISING PAGES, these valuable aids to low-cost production: the plant operation man's guide to **WHAT'S NEW IN EQUIPMENT** (page 140) . . . a summary of **LABOR DEVELOPMENTS** (page 220) . . . things **YOU WANT TO KNOW** more about (page 210)

MAINTENANCE

Here, again, one of the basic rules is to follow the instructions of the manufacturer. Don't use homemade parts; use only those made by the manufacturer. Material specifications, dimensions, clearances, and finishes are carefully and constantly controlled by the manufacturer to assure best results. When ordering parts, give all the information you can find on the reducing valve, including size, and serial number, if available. It is advisable to keep sets of spare diaphragms and springs on hand for emergency repairs.

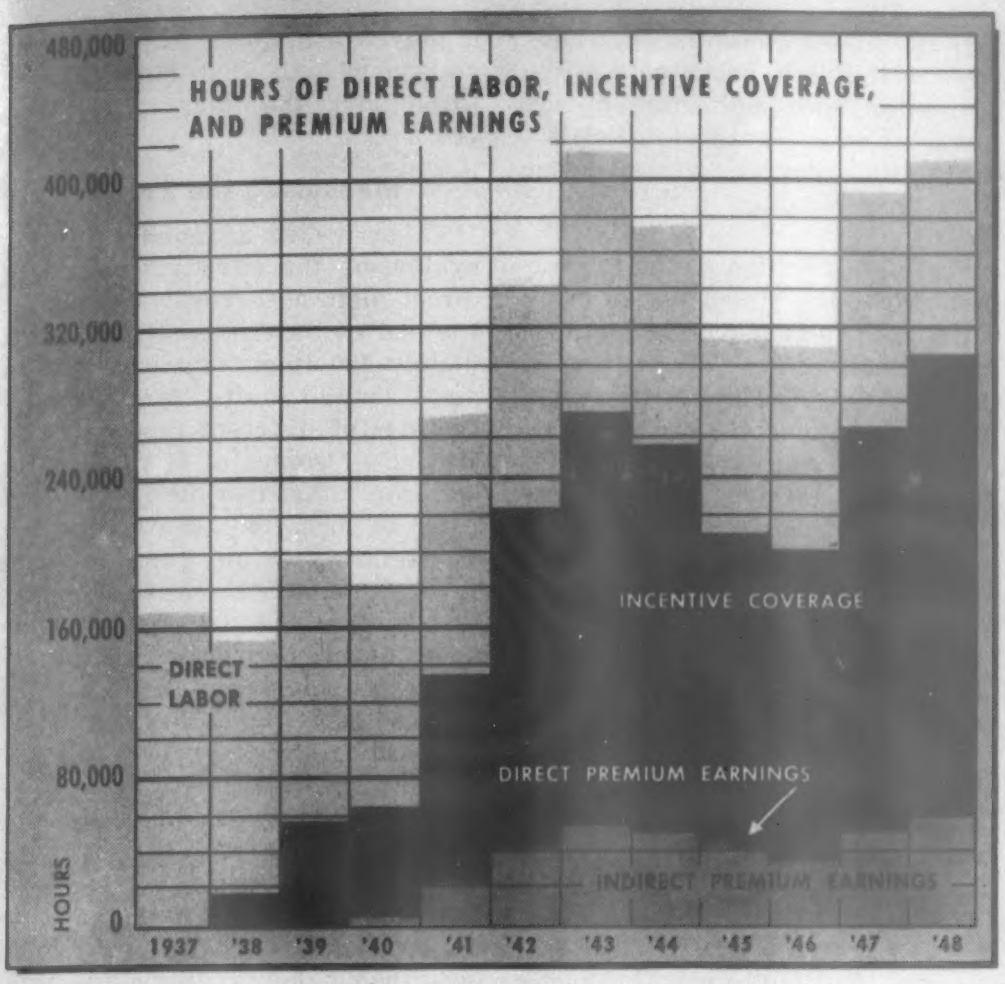
If a reducing valve has been properly installed and operated, it should require little maintenance attention. Valves which have a stuffing box or packing gland, should be checked at least monthly for leaks. Glands should be kept tight to prevent steam cutting of the stems and any other objectionable conditions, such as dripping condensate. In tightening packing glands, take care to see that excessive friction is not created on the stem so as to make the reducing valve sluggish or inoperative. If this condition develops, the stuffing box should be repacked. To test for a sluggish condition, close the downstream stop valve gradually and observe the movement of the stem, which should be free and not binding.

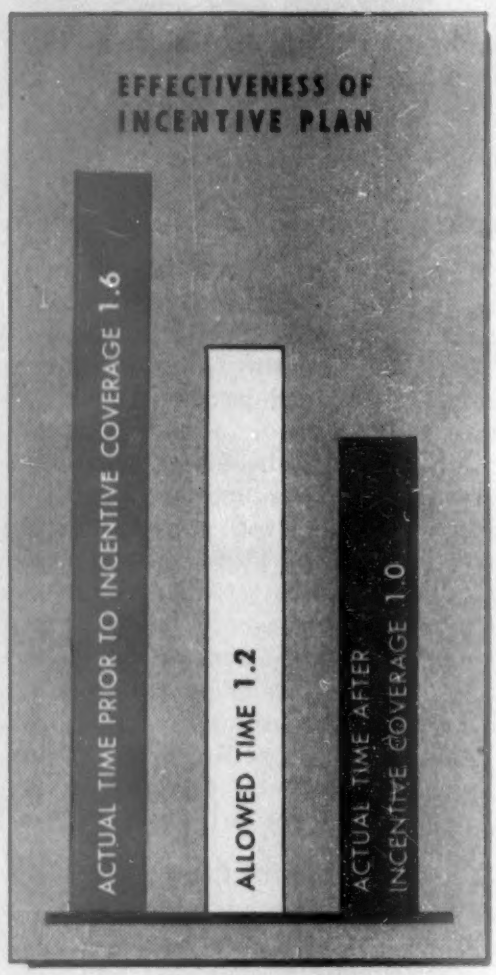
Steam leakage from a diaphragm chamber indicates a ruptured diaphragm which needs replacement. If a single-seated valve does not close tight, either there is dirt on the seat or the seat or disk is eroded.

The most common remedy for many troubles, including an erratic or non-working valve, is—take the valve apart, inspect it for wear and clean it. Wear can occur in the seat, valve, and stems. The diaphragm may crack or become distorted. Springs may be corroded or broken.

In piston-type valves, the piston rings or leather cups should be checked for wear or breakage. Piston rings should be clean and free in their grooves.

If a reducing valve does not operate satisfactorily after observance of these simple procedures, then it is best to arrange with the manufacturer for service by a factory-trained engineer.




EFFECTIVENESS OF INCENTIVE PLAN
ACTUAL TIME PRIOR TO INCENTIVE COVERAGE 1.6
ALLOWED TIME 1.2
ACTUAL TIME AFTER INCENTIVE COVERAGE 1.0

ALL WORKERS HAVE A PART IN THE SHARTLE INCENTIVE PLAN. CHART AT RIGHT SHOWS WHAT ACTUALLY HAS BEEN ACCOMPLISHED

OUR ELEVEN YEARS WITH INCENTIVES

Here's a plan that put the horse before the cart—workers *asked* to be time studied so they, too, could earn bonuses

RAYMOND K. HOVEL • TIME STUDY SUPERVISOR, SHARTLE BROTHERS MACHINE COMPANY, DIVISION OF THE BLACK-CLAWSON COMPANY MIDDLETOWN, OHIO

"I HEARD the company hired one of those efficiency experts. Up to now this has been a pretty good place to work, but he'll probably ruin everything!"

This thought, voiced by many operators and some foremen, aptly expresses the sentiment that prevailed at the Shartle Division in the fall of 1937. Top management had just engaged an industrial engineer to install an incentive system. His arrival was being viewed by many as an impending disaster.

Great was their surprise when a very quiet, very human individual appeared on the scene who seemed to have the knack of inspiring confidence in others upon his first contact with them. Had it been otherwise, our story would probably end right here!

As a preliminary step, the general manager called the superintendent and assistant superintendent to his office, introduced the industrial engineer to them, and explained the company's intentions of "trying out" an incentive system to see what it might do to reduce costs.

Then followed a round of introductions—to the foremen and to certain "key" operators.

The industrial engineer now made a careful survey of the entire plant, partly to analyze general conditions and formulate plans, partly to carry on a preliminary "selling" campaign. For an assistant he chose a green man from the shop and was careful to "sell" him thoroughly on the incentive philosophy before arranging for his permanent transfer.

Psychologically this was a good move. It served as an indication both of the simplicity of the proposed incentive system and of the fairness of the industrial engineer in using one of the company's employees instead of an outsider.

Taking into account the nature of this plant—a job shop of 350 shop employees with great variety of parts and small-quantity runs—the engineer now chose a few outstanding jobs on which to build a foundation. He believed that the successful coverage of certain operations would do three things:

1. Provide an opportunity to show management a favorable comparison between the time spent on those jobs before incentive coverage and that spent after it was worth the operator's while to apply himself to a greater extent.

2. Reveal to the operator in a definite manner just what good

skill and effort would mean to him in dollars and cents.

3. Reveal to the foreman how much easier incentives make his job in respect to keeping the operator attentive to his work.

The operator of a large vertical boring mill expressed his willingness to be the first guinea pig. Then followed the foreman of the small machine department and his entire group of men. Existing methods were broken down into component parts and analyzed for short-cuts and the elimination of waste motion. Experiments were made with cutting tools. And a few glaring weaknesses of design were corrected. But attention was particularly centered on time study coverage, the thought being to "start the ball rolling" by giving several machine operators the "taste" of incentive payments.

Direct Plan

When more and more employees became convinced that the industrial engineer was a "square-shooter" and that it would benefit them to cooperate, the requests for time studies became increasingly numerous. Within a few months after his arrival, the engineer found it necessary to add a second assistant to his staff. The "direct plan," as it was later called, was off to a good start.

With a few exceptions, the foremen remained skeptical and indifferent. Hardly anyone looked upon the incentive system as a function of the company. It was still rated as an experiment, something "we're going to give a whirl to see if it'll work."

For this reason a direct relationship arose between the time study department and the machine operator or other employee whose work could be measured. All personnel problems in relation to incentives were handled by a member of the time study staff. Each operator approached for the first time was given an explanation of the fundamental principles of incentives and the mechanical procedure of taking a study and deriving an allowed or standard time value.

The novice time study men were well instructed by the experienced industrial engineer. In addition, they began correspondence courses with a reputable industrial engineering school. In this manner it was not long before the time study men were well grounded in the general phases of incentives. They were now able to participate in the derivation and application of job formulas which were essential if a substantial degree of coverage were to be obtained in this type of plant.

For the derivation of the job formulas, tool experiments were again carried on extensively. Methods were thoroughly analyzed and standardized. And the cutting properties of various metals were accurately ascertained. The formulas were then derived from time studies taken in this plant on the proper method and conditions for doing the job. With the aid of such formulas, together with continued time studies, coverage spread rapidly throughout the shop. The consistency and fairness of the standard time values have been amply attested to by the lack of a single major complaint concerning the incentive system during its eleven years of existence.

Indirect Plan

Early in the history of Shartle incentives it was recognized that the work of certain individuals could not be practicably measured on an individual job basis—such jobs as tool grinding, machine maintenance, crane operating, crane following, sweeping, and yard work. Further, it was conjectured that non-participation in incentive earnings on the part of supervision could result in inequities between their take-home pay and that of the skilled operators in their departments, and perhaps contribute to the eventual stifling of all interest on their part. To compensate employees working on non-measurable jobs and eliminate the possibility of the inequities mentioned, a so-called "indirect plan" was inaugurated.

Unlike the direct plan under which each worker's incentive earnings are a direct result of the quantity and quality of parts produced, the indirect plan provides a common percentage of incentive pay to a great many individuals, all of whom can influence this percentage through cooperation with the direct employees. The amount of indirect incentive earned is based on the level of production attained by the direct incentive employees and on the ratio of the productive hours to the total hours worked by all employees. The indirect plan has consistently contributed to better production and it played a major role in the general good will that has obtained throughout the plant for many years.

Measuring the Results

To arrive at a sound basis for evaluating the effectiveness of the direct plan, a survey was made at the end of the first year. Approximately 130 items of varied nature were listed—shafts, forgings, and castings of different materials and size. Cost copies of from three to six orders that had been completed prior to incentive coverage on the particular part in question were next secured. From these cost sheets the average actual time spent on the part prior to incentive coverage was recorded. Then the allowed or standard time established by time study was recorded.

By this procedure 400 past orders involving more than 4000 pieces were examined, with the following results:

Labor required to produce these parts prior to incentive coverage was 16,501 hours. Standard time established to perform all operations on these same parts was 12,316 hours.

This meant that on the items in question the standard time was 75 per cent of the actual time formerly required.

The saving was not completely shown at this point, however, because the average direct incentive earnings during the period covered by the survey were 18.2 per cent. In other words, 10,400 hours, instead of 12,316, were required to produce what was formerly produced in 16,501 hours. One hour was now required to produce what was produced in 1.6 hours prior to incentive coverage!

Surveys made in subsequent years yielded similar results. A record kept from early 1938 to the present time reveals a saving of approximately 1,050,000 man-hours of labor.

But the benefits of the incentive system to the Shartle company do not stop here. Foremen and operators alike have become methods conscious. The foreman's job runs much more smoothly, because there is a high degree of direct incentive coverage (approximately 70 per cent of all productive work). Take-home pay of the Shartle employee is high among comparative industries. And the company's cost records are consistent and up to date.

ASSEMBLY BUCK SUPPORTS FRONT FENDERS AND GRILLE, MOVES ALONG CONVEYOR, SUPPLIES PARTS AND TOOLS TO OPERATORS AS NEEDED

SPECIAL FIXTURES KEEP ALL PARTS CLOSE TO ASSEMBLY POINT

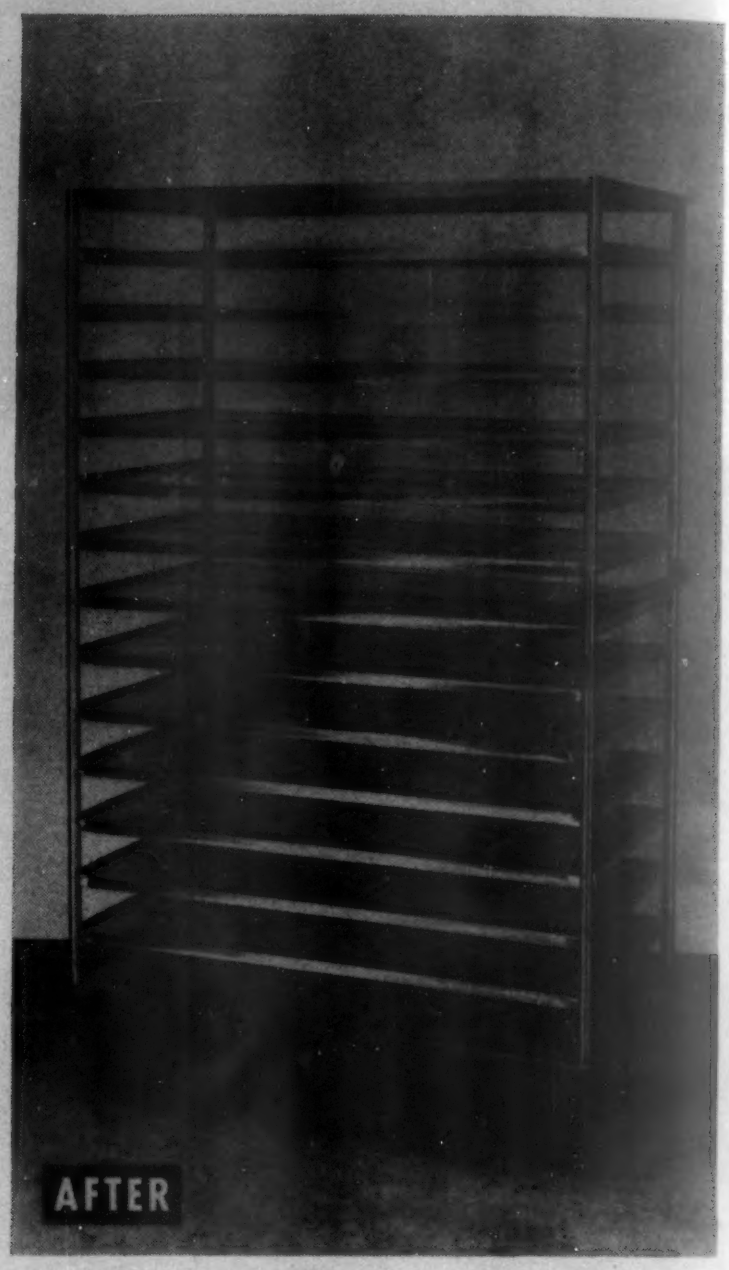
Packard applies work simplification principles to sub-assembly operations. Result—time cut one-fourth

ASSEMBLY "BUCKS," used for the front fender and grille assembly, were designed and are used so that all tools and parts will be at the workers' fingertips at Packard Motor Car Company, Detroit.

The buck is mounted on rollers and moves around the front end assembly merry-go-round conveyor. Steel pans are attached at different levels, the purpose being to have all parts and tools immediately available at the various points of assembly. When the worker performs the interior assembly operations, he sits on a swivel stool. The assembly buck was designed with an eye to application of the ultimate in work simplification principles. Management wanted to keep all motions within the normal work area.

Before, assembly workers had to search for the various materials required in assembly. Now searching is completely eliminated. Workers used to walk considerable distance, too. Now all the walking has been eliminated.

The results speak for themselves —assembly time has been reduced more than 25 per cent; materials handling is minimized, considerable floor area has been saved, and the job is easier for the workers.



FASTER CLEANING, by 31 per cent, was result when old wooden pie racks were replaced with stainless steel ones. Additional advantages: 9 per cent less breakage, 23 per cent faster cooling from greater conductivity

APPLYING WORK SIMPLIFICATION

DON F. COPELL • CHIEF ENGINEER, WAGNER BAKING CORPORATION, NEWARK, N. J.

THE VERY NATURE of a maintenance man's work makes it necessary that he understand, believe in, and adhere to the basic principles of work simplification.

True enough, there is little repetitious work in a normal maintenance department, but there certainly is a lot of hand and leg work going on day and night.

Plants, machinery, equipment, tools, space, and other facilities under the jurisdiction of the maintenance department offer potentialities for elimination of waste.

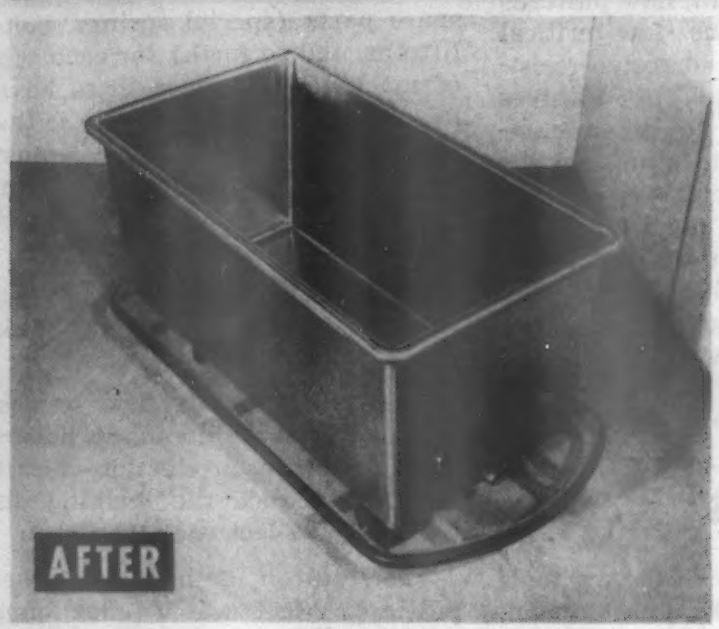
The high cost of maintenance today clearly indicates that it is later than we think, and those well-proved principles of work simplification are as much a "must" in a maintenance shop as they are on the production floor.

Every one of Wagner's maintenance supervisors, and most of the maintenance men, have attended our regular work simplification classes. This instruction has made our maintenance force of incalculable value to the production men, who are always thinking up new gadgets to improve methods, or cut down wastes of all descriptions.

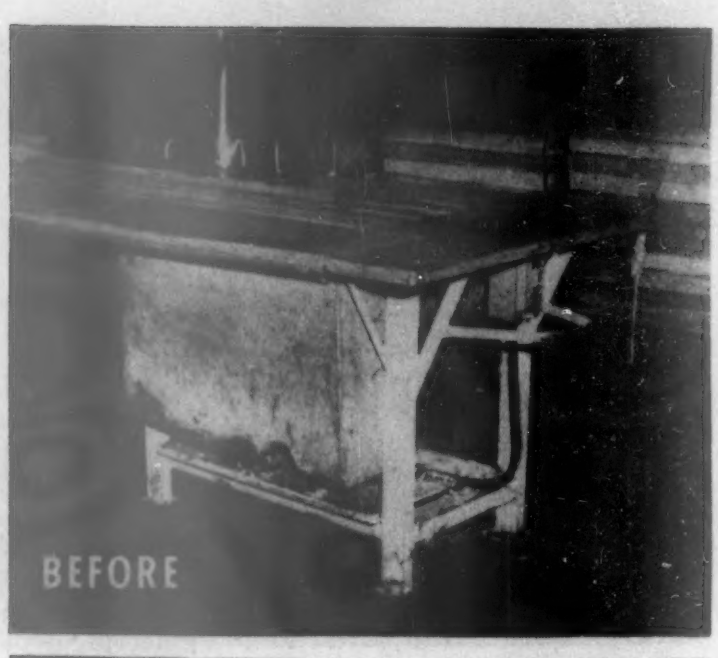
Before the maintenance and production supervisors received their training in work simplification, there was much misunderstanding, friction, and even some professional jealousy between these two departments.

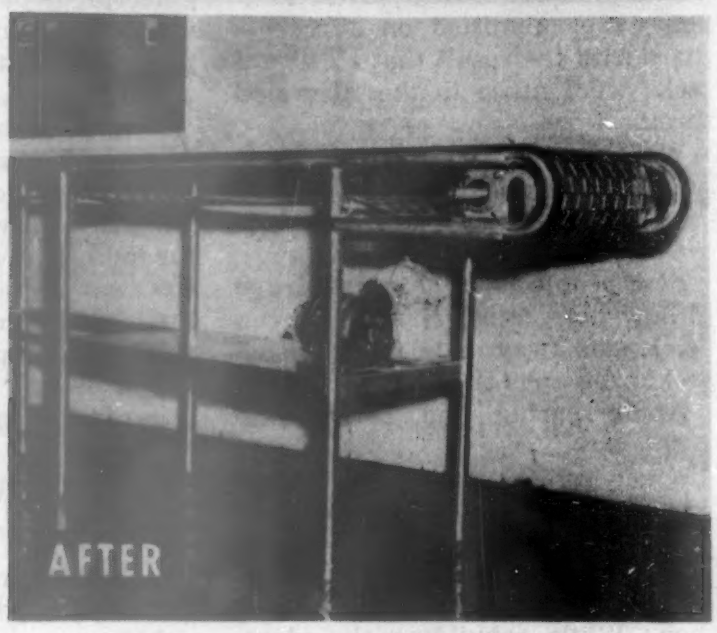
The maintenance supervisor was reluctant to give new ideas a try if they emanated from the production floor, and the production supervisor sometimes turned a cold shoulder on gadgets proposed by the maintenance department.

Now, let us look at some of the things that have been worked out since work simplification brought production and maintenance departments together.



REDUCED LOSS of apple juice paid for leak-proof, all-metal, welded apple troughs in 16 months





MORE SANITARY conditions resulted when hard-to-maintain conveyor was replaced with more modern one

TO PLANT MAINTENANCE

SIMPLIFICATION OF EQUIPMENT

Every week, the old, wooden apple trough had to be tightened up to prevent leakage. Sometimes the maintenance man did not get around to it. As a consequence, a lot of expensive apple juice was lost and the production floor (where the troughs were stored) had to be mopped up frequently, to prevent employees slipping and injuring themselves. This was a condition that obviously called for remedial action as soon as possible.

When the time came for the troughs to be replaced, a joint recommendation from the production and maintenance supervisors called for stainless steel troughs of all welded construction, to eliminate loss of valuable juice, and accident hazards.

The troughs were fitted with rubber bumpers all around (to prevent damage to knuckles, tile walls and equipment) and were easy to clean (to reduce maintenance cost).

The saving in apple juice alone paid for the troughs in 16 months, and we have not had a scraped knuckle in two years. *What about maintenance?* A trough can now be cleaned in 6½ minutes, where it took 14 to 18 minutes before, and there is no need for a rush every Saturday when the maintenance men want to go home.

The question of conveyor maintenance is one of those allergies to which most maintenance men in food industries have become thoroughly accustomed.

To keep equipment spick and span for the food and drug inspectors is a serious maintenance problem. Hours of scrubbing, steaming, and wiping are routine maintenance work every night.

Our president some time ago insisted that all future equipment had to be of sanitary construction, even if we had to build it ourselves. We tackled this problem, and came up with a sanitary, good-looking conveyor design which has paid us handsome dividends in reduced maintenance and cleaning cost, as

well as reduced breakdowns. One plant reports a saving of 280 man-hours a month since the installation of these simplified conveyors, shown in the photographs at the right of page 91.

For centuries, it has been customary to use wooden racks for storing bakery products. These racks are a source of constant maintenance and we started to apply the questioning technique to this job. Why not use stainless steel as we did on the apple troughs? "Why not?" said the production man, who was thinking of the higher conductivity of metal, which he would put to use to cool his pies faster.

The problem and a partial solution were submitted on a process chart with the result that all future racks were made to the suggested specifications.

What did the company gain? Just 23 per cent quicker cooling, 9 per cent less breakage, and a 31 per cent decrease in cleaning time.

Few people have any knowledge of how destructive apple juice can be. It eats away metal like a woodpecker destroys trees.

Apple paring and coring machines are a source of constant maintenance. A few delicate parts are the very heart of the machine. Unless these knives are properly adjusted, the peeling loss, which should normally be about 8 to 10 per cent, can amount to 25 per cent of the weight of an apple in a few hours.

We used to spend an average of 9 hours of a maintenance man's time a week, per machine, to keep it properly adjusted, and about $3 worth of parts had to be changed weekly. Besides that, operators were losing valuable hours waiting for the maintenance men.

Again, with the help of the engineering department, new patterns were designed. The few critical parts were cast of a corrosion-resistant material, and the knives changed according to the maintenance man's idea, to eliminate the possibility of clogging.

When everyone started looking for the better way, the maintenance cost was reduced 68 per cent, and the maintenance hours per machine from 9 to 4 per week.

The peeling loss is now constant at around 10 per cent.

RELOCATION OF FACILITIES

Our maintenance department used to be adjacent to the bakeshop. While rebuilding the plant, it was decided to put a new kitchen in the place formerly occupied by the maintenance department.

The maintenance, carpentry, and power engineering departments were consolidated in a remote corner of the plant, because we needed every inch of floor space for our streamlined production layout.

While the consolidation of the service department saved us a great deal of money, kept the danger of getting foreign substances into our product to a minimum, and gave us better supervision over our high-priced mechanics, we soon noticed that the downtime on machines had taken a turn for the worse.

From records we estimated the cost of downtime to be $22.50 per pie machine per hour. The downtime cost of the entire bakeshop in a plant amounts to $87 per hour.

Although the new setup reduced the distance from the maintenance department to the apple room, the pie machines were now 165 feet farther away and on another floor, necessitating the use of slow-moving elevators whenever heavy tools were needed to repair a breakdown.

Also, a repair man would sometimes be called to the bakeshop and upon arriving there would discover that a certain part had broken or that he needed a special tool for the job. He would then have to return to the machine shop for the needed item while seven operators stood by idly, waiting for the machine to be put back into service. *This was obviously an example where we really needed some work simplification and a case where a simpler way would pay out in handsome dividends.*

The problem was discussed for days. The discussion resulted in a proposal for the following changes:

1. Install an intercommunication system between maintenance and production departments.

2. Instruct each supervisor calling for a mechanic to describe in detail the extent of the breakdown.

3. Install a cabinet with special adjustment tools close to the pie machines.

4. Make up special toolboxes with spare parts (special springs, bolts, liftpins, and so forth) for each type of machine, and place these boxes near the particular machine so that the mechanic can make adjustments and repairs without having to return to the repair shop to pick up his tools.

5. Instruct one operator at each machine so that he could make minor adjustments.

6. Install an emergency staircase between the maintenance department and the production department, to reduce the walking distance by 120 feet each way.

The result of the proposals, when put in to effect, was a reduction of 81 per cent in walking distance, and of 38 per cent in average repair time per job.

In a recent week, for instance, the downtime was a mere 43 minutes compared to an average of 109 minutes for each of the previous four weeks. Does it pay to apply work simplification to maintenance work when the reduction of every hour of downtime means $87 saved? *It certainly does.*

MAINTENANCE TIME TICKETS

A maintenance supervisor used to spend two hours a day filling out time sheets, allocating work to 146 accounts.

During one of the work simplification classes he asked the office manager what all these figures were used for.

"I'll be darned if I know. It's the people upstairs who want them," was his answer.

The chief engineer was asked what use he made of the time sheets. "Oh, I just group them into about 25 accounts for my report to the plant managers," was his reply.

The outcome of all this was a simplified time report which takes but 35 minutes a day to fill out. Thanks to work simplification an additional 1 hour 25 minutes a day can now be devoted to maintenance supervision.

Wherever, whenever work is performed by or through human beings, work simplification will make that work easier, and result in lower costs.

Maintenance work is certainly no exception!

CONTAINED IN THIS Plant Operation Library section are condensations of papers prepared for the annual meeting of the Council of Profit-Sharing Industries, to be held November 8 and 9 in Chicago. Eight successful profit sharing plans are described here

1. Wage Dividend Plan. *W. H. Wheeler, Jr., President*
Pitney-Bowes, Inc., Stamford, Conn. 94

2. Joint Earnings and Trust Plan. *Fayette Sherman*
Employment Manager, Geo. D. Hormel & Company, Austin, Minn. 95

3. Trust Plan. *William Wallace, Executive Director, Savings and Profit Sharing Pension Fund, Sears, Roebuck & Company, Chicago* 96

4. Profit Sharing in Multiple Management. *Thomas R. Reid, Vice-President in Charge of Human Relations, McCormick & Company, Baltimore* 97

5. Combined Trust and Bonus Plan. *Cass S. Hough, Vice-President*
Daisy Manufacturing Company, Plymouth, Mich. 98

6. Bonus Plan. *James F. Lincoln, President*
The Lincoln Electric Company, Cleveland 100

7. Cost Savings Sharing Plan. *Wendell W. Anderson, President*
Bundy Tubing Company, Detroit 101

8. Share-of-Production Plan. *A. J. Woodfield*
Personnel Relations Supervisor, Continental Paper Company, Ridgefield Park, N. J. 102

EDITOR'S NOTE: The Council of Profit-Sharing Industries is composed of companies that have active profit sharing plans. Its purpose is to promote profit sharing as an important means of preserving the American system of individual initiative. Profit sharing is defined as "any procedure under which an employer pays to all employees, in addition to good rates of regular pay, special current or deferred sums, based not only upon individual or group performance, but also upon the prosperity of the business as a whole."

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1

WAGE DIVIDEND PLAN

W. H. WHEELER, JR.
President, Pitney-Bowes, Inc.
Stamford, Conn.

Walter H. Wheeler, Jr., picked up a Croix de Guerre in World War I, got himself a job in 1919 as a factory worker at the Pitney-Bowes' predecessor company. Became PB president in 1938. During World War II served with the Office of Production Management and War Production Board. Is presently chairman, Stamford Housing Authority; member, Business Advisory Council, Department of Commerce; chairman, Industrial Committee, New England Council.

THE WAGE-DIVIDEND method of profit sharing at Pitney-Bowes is basically a method under which profit sharing payments are declared periodically as a percentage of regular compensation.

After the war we decided, although we had been paying a bonus of 7 per cent of base pay, we were not getting the full benefits from our bonus plan; first, because it was paid only once a year, and second, because our technique did not tie in closely enough to partnership with stockholders. Instead we instituted a new system of quarterly wage-and-salary dividends to be considered by the directors when stockholders' dividends were considered.

"The new plan," we said, "is based on the conception that employees invest their time and services in the business in a manner somewhat similar to the stockholders' investment of funds. We are all essentially engaged in a cooperative undertaking. Employees receive their compensation first in good salaries and wages whether or not dividends can be paid. Then, if the results of the operation are profitable, stockholders must next receive fair dividends in return for their funds invested. It is only when the earnings of the company provide for more than these two fundamentals that any fair profit sharing between stockholders and employees can take place."

Our first quarterly dividend in February, 1946, was at the rate of 7 per cent of base pay. With an extra dividend of 3 per cent at the end of the year, comparable to an extra we had been paying stockholders, the first year's payments amounted to 7.75 per cent of base pay. In 1947 the total was 8.8 per cent of base pay, stockholders' dividends also having been increased during this period.

Our plan also provides for an employee leaving his dividends with the company to accumulate 3 per cent interest until December if he so desires. About two-thirds of our employees do this.

Employees understand that at every quarterly meeting of the directors, when dividends to stockholders are considered, dividends to them will also be considered on the broad premise outlined. There is no formula. We have even told our employees that additional profits we might make through embarking on new risk ventures would weight the scales in favor of the stockholders, and might mean larger dividends for them, without necessarily increasing employees' dividends. We have also pointed out that stockholders' dividends have been abnormally low because of the need to reinvest our profits in the business, and that they must be increased without necessarily any proportionate increase in wage and salary dividends.

But we have also told them that increased profits caused by better efficiency would incline the scales in their favor, and those resulting from general prosperity would be equally shared. They appear to have faith in our fairness. At least our morale has never been better nor our productivity better—25 per cent improved since the war.

The day after a quarterly dividend meeting, a notice is posted on the bulletin boards announcing the declaration of the directors, both with respect to stockholders' and employees' dividends. Following that, in three or four weeks, a notice is sent to each employee showing the exact amount of his dividend, together with a slip to be returned asking for a check or the amount to be left to accumulate interest. The check follows a few weeks later if the employee wants it currently.

In this manner we have a routine which constantly keeps before our employees the fact that we are operating a profit sharing plan. This is supplemented further by a quarterly letter I write to each employee just as I write to stockholders. In addition, we have an annual jobholders' meeting—similar to the stockholders' meeting—at which the problems and policies of the business, both past and future, are reported and discussed.

We use direct incentive systems wherever they can be applied. We have seven paid holidays, and group life insurance providing death benefits of about twice annual earnings, over half the cost of which is carried by the company. We have a hospitalization plan on a contributory basis, and a stock purchase plan in which an employee may invest about 10 per cent of his earnings in stock of the company over 3-year subscription periods, during which he may at any time withdraw and receive his money back with 3 per cent interest.

We keep our wages and salaries equal to or above those generally prevailing in the community. We operate a job evaluation program and have periodic reviews of the performance of all employees with merit increases based thereon.

Until this year we had an insured pension plan, about half the cost of which was contributed by employees. We have recently materially liberalized the plan, turned it into a trust fund and made it non-contributory, reducing our wage-and-salary dividend payments by about 20 per cent to offset a portion of the added cost. The plan now provides an average employee having 30 years of service with a retirement income at 65, including federal old age benefits, equal to about half of his earinings during his highest paid ten years.

We regard this retirement trust, into which the directors make a

quarterly declaration just as they do on the wage-and-salary dividends, as part of our profit sharing plan. We show both payments as separate items on our financial statement to stockholders. Incidentally, this report is in the same form as the one we provide for our employees.

At current rates, the cost of these two plans is about equal to the amount paid to stockholders in dividends. The average employee receives more in dividends than the average stockholder, there being 2300 employees and over 5500 stockholders. These facts may sound surprising, but actually our program is relatively modest. This year the wage-and-salary dividend will probably be between 6 per cent and 7 per cent of base pay, and our pension trust is no more liberal than that of a large number of other companies.

The point I want to make is that, by the adoption of the proper technique, almost any company that is paying or can afford to pay a modest year-end bonus in prosperous years, can enter into more effective profit sharing very readily in a manner similar to ours. Moreover, if the company has a large labor content in the dollar of its operation costs, it can present a very convincing profit sharing picture to its employees.

2

JOINT EARNINGS AND TRUST PLAN

FAYETTE SHERMAN
Employment Manager, Geo. D. Hormel & Company
Austin, Minn.

Fayette Sherman joined Hormel when he finished high school in 1919. He served in various minor capacities until 1933; was then placed in charge of personnel. Since then he has negotiated working agreements for the main plant and its branches. Has headed up Hormel's annual wage and wage incentive plans since their inception.

IN 1939, the Hormel Company announced the joint earnings plan which is the Hormel version of employee profit sharing. Joint earnings is an arrangement separate from the annual wage plan. All Hormel employees who are on the payroll at the beginning and the end of any given fiscal year are eligible to receive the joint earnings for that year. Those quitting or starting during the year do not participate.

The first computation is the gross income of the company from which all expenses of operation are deducted, including the services and salaries of the employees who did not participate because they were not eligible, but not including the wages and salaries of the joint earnings employees. Thus, all sales and miscellaneous income or credits and all expenses except salaries and wages are deducted from what we call the joint earnings account. The division between the employees and the stockholders of the amount that is left, or the joint earnings amount, is on a sliding scale.

For example, if the total income of the company, after all expenses except salaries to employees, were $1000 and the business had one employee whose wage was $1000, then there would be no earnings for the stockholders and the employee's share would be 100 per cent. But if the income of the company were $1500 and it had one employee whose salary was $1000, then $500 would be available for the stockholders and the employee to share on the basis of the sliding scale, which at that particular point of 150 per cent joint earnings amount, would be divided, 78 per cent to the employee, or $1170. But the employee has already received $1000 in salary, so his joint earnings check would be $170—17 per cent of his regular salary. At this point, the stockholder would get 22 per cent of the amount in the joint earnings fund, or $330. The percentage to the employee, of course, is reduced as the earnings go up.

If this plan were applied to another business, consideration would have to be given to the normal profits, and the percentage allocated to the employees and stockholders would naturally vary with the kind of business. This extra income is received by the employees after the public accountants finish the annual audit of the company business. Payments are in a lump sum. These payments have varied from a little more than one check in the first year of operation to better than eight checks one year.

In 1944 our company took advantage of previous amendments to the Internal Revenue Code and established a profit sharing trust plan which is in effect today.

It is felt that a sufficient amount will be put into this trust in good years to build up a fund that will be ample to take care of our older people when they retire. In years when we have no profits, there is no fixed obligation to be met.

Employees do not participate in this plan until they have 4 years of continuous service with the company. The rate of participation is based on length of service, with a rate of increase growing slowly during the early years and rapidly as the man approaches 26 years of service. The aim of the plan is to provide greater benefits to older employees as they approach retirement. Officers and employees participate alike—based on length of service. Employees do not contribute to the trust fund.

When the taxable income of the company is average or below, the company contribution to the trust is very small. When it is above average, the contribution is greater. The amount the company contributes is based on two formulas—one based on per cent of net profits to sales, the other on net profit per hundredweight of sales tonnage. Whichever formula produces the greater contribution by the company is the one to be used for that year.

The year 1944, the first year that

our profit sharing trust plan was in effect, the profits were unusually high and the company's contribution to the fund was approximately $1¼ million. This money was allotted to the employees on a formula which was approved by the Revenue Department and each employee was issued a booklet, much like a bank book, with space allowed to make additions to his accrual in future years. There are 127 employees who have $7329.29 to their credit now. This money is deposited with the trustee—the First National Bank, Minneapolis—to the credit of the individual.

Once the money is deposited in trust, it is no longer the property of the company and will be paid to the employee at the discretion of the trustee, within the terms of the trust agreement: (1) If he leaves the employ of the company; (2) upon his retirement at the age of 65; or (3) paid to the employee's designated beneficiary in case of death. Contributions will continue to be made to the employee until he has to his credit an amount which is the lesser of $20,000 or 6 years' base pay. Contributions to his credit will then cease until 30 per cent of participating employees have to their credit an amount equal to 3 years' base pay.

3

TRUST PLAN

WILLIAM WALLACE
Executive Director, Savings and Profit Sharing Pension Fund
Sears, Roebuck & Company, Chicago

William Wallace has been with Sears, Roebuck for 35 years. He started in the shipping room, and is now executive director of the savings and profit sharing plan. Born in Scotland, he came to America as a young man. Previous to his Sears connection, he worked on farms. His formal education ended when he was 15 years old, but he has taken innumerable night school courses, and read and traveled widely.

FOR ONE associated 35 years with a company that has had a retirement plan in operation for the last 32 years, it is difficult to see how any company can afford to be without one. Our profit sharing plan was in effect some 21 years before Social Security became a federal law.

A true profit sharing plan cannot be successful when used as a substitute for anything else. Wages must equal or better those paid in related lines of industry. Paid vacations, sick allowances, and other employee benefits must equal or better competition. Working conditions must at least equal those offered by competitors. Profit sharing is something extra.

When our profit sharing plan started in 1916, the following were given as the three basic reasons for installing it:

1. To permit employees to share in the profits of the company.

2. To encourage saving.

3. To provide a plan through which each eligible employee may accumulate his own savings, the company's contributions, and the earnings on his accumulations as a means of providing an income for himself at the close of his active business career.

These three reasons are still our foundation.

Naturally, it has been necessary to amend our plan from time to time to meet the changing social conditions. The question of retirement can be measured in many different ways. Employees nearing retirement, when they feel security prices are right, may recommend to the trustees that part or all of their securities be converted to money. The money is held in profit sharing until retirement or may be used for the purchase of single payment annuities.

Our plan has certain partial withdrawal privileges whereby an employee may make withdrawal of part of his credits for the purpose of buying a home, retiring a mortgage, repairing a home, and, in some instances, investing in government bonds. He retains his membership in profit sharing, and it in no way affects his participation. The participation is as follows: (one year of continuous service is required before being eligible to join the fund):

Group A—depositors who have less than five (5) years' continuous service.

Group B—depositors who have five (5) years' and less than ten (10) years' continuous service.

Group C—depositors who have ten (10) or more years' continuous service, excluding depositors who have fifteen (15) or more years' continuous service and are over fifty (50) years of age.

Group D—depositors who have fifteen (15) or more years' continuous service and are over fifty (50) years of age.

Initial participation is voluntary. So is continuation of membership. Approximately 99 per cent of all eligibles are members. If membership is terminated either by the employee or by the company before the employee has attained 5 years' continuous service, he receives his own money plus 5 per cent interest. After 5 years of continuous service, all cash and securities credited to his account, regardless of reason for terminating his services, or for terminating his fund membership if he wishes to stay on payroll, are given to the employee.

Sears' profit sharing plan is operated by a board of six trustees selected by the directors of the company. Three of these trustees are officers of the company, two are employees of the company but are not officers or directors, and one is not an officer, director, or employee of the company.

In addition, the employees have elected representatives in the form of an advisory council. These employee representatives meet twice a year in Chicago. They bring with them the viewpoints of the employee members in the field. No changes are ever made in profit sharing rules without the advice and consent of the advisory council.

Now we come to the payoff at re-

tirement time. Following are three typical cases:

A went to work for Sears in 1912 and had never earned more than $2291 a year. He began putting money into the fund when it was established in 1916. He withdrew enough to pay for his home. Then he withdrew some more and built a summer home. He came to the office some time ago and said, "I'm retiring." His credits were on that date $9426 in cash and 400 shares of Sears stock worth approximately $47 a share. Not many people can retire at 65 as this fellow did—with two homes paid for and about $27,000 to be paid to him over a period of five years. (His total deposits amounted to $2508.)

B was employed by the company in 1913 and joined the fund in 1916. He had to retire from the company at the age of 55 because of illness. From his credits the fund purchased for him an annuity policy to pay him $200 a month for as long as he lives, with any unpaid balance at his death reverting to his wife and children. In addition to this, he had accumulated 1027 shares, which, at the time he retired, had a market value of $46,100. (His total deposits amounted to $6898.)

C retired from the company at regular retirement age. His credits at the time of closing his account were 2246 shares and $7947 cash. His total profit, including previous withdrawals, amounted to $106,564. (He had deposited in profit sharing from his wages a total of $6007.)

All the above employees joined profit sharing when it started. Another employee who retired two years ago, and who under the rules and regulations had withdrawn money to purchase annuities, told me that the income from his annuities, plus his monthly Social Security payment, provides him with a retirement income, practically guaranteed for life, equal to his salary before retirement.

Our plan is especially suited to our organization. It has been successful because the business and the organization have been successful. Sears has been a money maker; has paid liberal dividends.

The success of any plan will depend upon the type of organization, whether male or female, average length of service, business fluctuation, payroll turnover, earning capacity of the company, capital structure of the company, and so forth.

PROFIT SHARING IN MULTIPLE MANAGEMENT

THOMAS R. REID
Vice-President in Charge of Human Relations, McCormick & Company
Baltimore

Thomas R. Reid was selected by the U.S. Junior Chamber of Commerce as one of America's outstanding young men of 1947. Not only is he vice-president in charge of human relations at McCormick & Company, he is also executive vice-president of the Society for the Advancement of Management, and chairman of the Employee Relations Committee of the Grocery Manufacturers of America.

ONE OF THE FEATURES of the McCormick multiple management plan is the profit sharing system which, in accordance with board recommendations, has been organized along these lines:

A pension plan insures the fully qualified employee at age 65 approximately 40 per cent of average salary when Social Security benefits are added to the payments.

A profit sharing trust supplements the pension plan, in which all employees participate after 3 years of service. Between 15 and 25 per cent of the company's profits before taxes are deposited in this fund for the use of employees at the retirement age of 65. Payments from this fund are also available to them, upon application, in the event of total disability or severance of connection with the company. Totally disabled employees continue to receive payments from the trust as long as they live or until they reach the retirement age of 65, at which time they are paid any balance remaining. In addition, funds deposited in the trust can be used by the individual participant to purchase retirement annuity contracts and life insurance coverage, if they so desire.

The company has followed a plan of profit sharing with employees with bonus payments made during the course of the year whenever sufficient profits are available. The amount to be distributed is determined by the senior board of directors after a review of company operations, and the amount varies from year to year in accordance with the company's ability to pay. Bonuses have been paid at the end of each quarter of our fiscal year to date.

Bonuses equivalent to 1 to 7 weeks' salary per year have been paid during the operation of multiple management. This is in addition to vacation pay, plus 7 paid holidays and a 10-day vacation at Christmas.

The company has a group life insurance plan with a maximum coverage of $10,000 for employees earning in excess of $65 per week. This coverage scales downward according to salary, and the premiums are paid for jointly by the employee and the company.

There is also an employee-operated sick benefit plan, supported by employee and company contributions, which entitles the members to payments upon their first day of absence on a basis of three-fourths of their base pay. The duration of payments ranges from 2 to 26 weeks, depending upon length of membership.

McCormick also has the Blue Cross Hospital insurance and a complete medical program.

Our company has grown to four times the size it was in 1932. And what do the stockholders say to all this? They have only praise because they have made money. Their dividends have increased as productivity increased and as costs and waste went down. Their dividends increased because profits were better. Everybody has benefited. That is what better human relations can do.

CONTINUED ON NEXT PAGE

5

COMBINED TRUST AND BONUS PLAN

CASS S. HOUGH
Vice-President, Daisy Manufacturing Company
Plymouth, Mich.

Cass Hough was graduated with honors from the University of Michigan. He joined Daisy in 1926. Became general manager of a Daisy subsidiary in 1929, then a Daisy vice-president and director in 1931. Was a colonel in the Air Force in World War II. Flew over 100 combat missions, awarded DFC and Air Medal. Is chairman of the Michigan Aeronautics Commission.

A TRUE profit sharing plan is a definite sharing of the earnings of the business between stockholders and workers. It must be expressed as a percentage of the net operating profits of the business before taxes (so that credit can be had before the assessing of federal taxes) and definitely, in computing the net operating income, should exclude such items as discount received and discount paid or allowed, interest received and paid, income from rents, royalties, and other items which are not a part of the operating picture of the business.

The agreement for profit sharing must be guaranteed for at least one year. At its inception it would be wise to guarantee it for longer than one year, because it is our considered opinion that it takes more than a year for a plan of this kind actually to soak in, so that all the benefits which can be derived from it will be realized.

At any rate the profit sharing must be so arranged that, after the start of any fiscal year or calendar year, on whichever basis the business may operate, the plan cannot be changed until the end of that year and, by the same token, if carried on into the succeeding fiscal year or calendar period, it can undergo no change or curtailment during that period.

A profit sharing plan must never be even thought of as a substitute for fair wages and salaries. The business must be operated, in so far as wages and salaries are concerned, as though the profit sharing plan did not exist. Otherwise it is not a true profit sharing plan. It is our opinion that over a period of time, come depression periods, with a profit sharing plan in the background organized labor can be taught the necessity for reducing wages as well as increasing them, so that the business will not be handicapped by excessively high wage rates, nor on the other hand will the employee be handicapped during periods of extremely high living costs. It is our opinion that, as partners in this business, our employees will consider the problems of the business as their own problems (which they are) and not merely relegate them to problems of management.

A true profit sharing plan must include all personnel on an equal basis. If top management personnel are to be considered as deserving more under a profit sharing plan than, let's say, coal heavers or coal handlers, or press hands, then it is necessary to come to a separate profit sharing agreement with those personnel.

But under no circumstances should a profit sharing plan be drawn up which will give a larger percentage of the amount to be shared to certain individuals. The group must be considered as a team, and if he is good enough to be playing on the team, it must be assumed that each worker, regardless of his job, is contributing to the team play to the very best of his ability. Arguments that foremen, toolmakers, and others in this category should be given a larger percentage of the profits, or that the division of the profits should be on the basis of an employee's pay, are not sound ones, if a real profit sharing plan is to be instituted. It must be assumed that technical skill, such as toolmaking, is recognized in the wages or salaries paid that individual; that, after having recognized these differences in technical skills by wage and salary differentials, the earnings derived from this team effort should be shared and shared alike.

The above is a rough outline of the thinking of the management of this business, and there follows a more concrete outline of the plan as now in operation.

The management group of this business consists of the factory manager, the director of purchases, the director of personnel, the director of sales and advertising, the director of production engineering, and the executive vice-president of the business—none of whom is a stockholder in the business, with the exception of the executive vice-president who owns only enough stock to qualify him to sit on the board of directors. A trust agreement has been drawn up between this group and the company, agreeing to pay over to the management group an amount equal to 10 per cent of the net operating profits of the business before taxes each year. Three of this group, who have the longest service with the company, are designated as the trustees for the management group trust.

Sharing of the amounts paid over to the management group trust is on a share-and-share-alike basis, providing each of the above-named beneficiaries has completed a full year. If they do not complete a full year, either by leaving or being fired or perhaps being hired after the year has commenced, they receive an amount equal to the percentage that their months of service bear to the 12-month period. The three trustees, by unanimous vote can remove any other beneficiary of the management group, or can add some key person in management if they so desire.

This agreement is not changeable or cancellable at any time during the fiscal year. It can be terminated at the end of a fiscal year or can be changed, but once a fiscal period has begun it cannot be changed or terminated.

The company has executed a trust agreement between the executive vice-president and the company, which stipulates that, for

each fiscal year the plan is in operation, the company will pay over to the trustee an amount equal to 30 per cent of the net operating profits of the business before taxes. The trustee is charged with the distribution of these funds to eligible employees. For distribution, half of the amount paid over to the trustee (or 15 per cent of the net operating profits) is to be paid out in cash, and the other half is paid into an employee retirement fund. Like the management group profit sharing trust, this agreement cannot be terminated or changed at any time during the fiscal year, but can be terminated or changed at the close of a fiscal year prior to the opening of a new fiscal year.

The distribution of cash under this plan is on a share-and-share-alike basis, the only exceptions being that no probationary employees may participate, nor will their probationary period count in participation, and that the distribution is made on the basis of the number of hours worked by the employee during the year. It is assumed that an employee who has been here during all the working hours of any period contributes more to the earnings of the business than an employee who has been here less than that time, so the cash distribution is made on a basis of actual participation of the employee during the year.

In administration the total amount to be distributed on a cash basis is divided by the total number of hours worked by employees present at that time. This gives a per-hour figure, which, when multiplied by the number of hours that an employee has worked during the period, determines the employee dividend. The agreement stipulates that an employee, to be eligible to receive part of this cash distribution, must be on the payroll of the company at the close of the fiscal year for which payment is being made.

Employees Credited

Fifteen per cent of the net operating profits of the business are paid to the Detroit Trust Company as soon after the close of the fiscal year as possible. The Detroit Trust Company then credits a certain amount to each employee, based on the number of points held by that employee. Points are determined as follows: Three points for each year of service (going back 15 years and only 15 years from the date of inception of the plan), two points for each $100 of salary up to $2000, and one point for each $100 of salary over $2000. Thus the plan is slanted towards the lower income groups and puts a high premium on continuous service, which is just what a retirement plan should do.

An employee has no vested interest in the amount credited to him in this retirement plan until he has completed at least one full year of service. For each full year of service, an employee receives a vested interest of 10 per cent in the amount credited to him, so that at the end of 10 years of service, the entire amount credited to his account is available to him should he die, be fired, or decide to leave.

Most retirement plans have such a long vesting schedule or run over such a long period of time, that they actually represent very little in a tangible way to the employee. In our plan, 10 years' service, which is required to receive a 100 per cent vesting in the amount credited to the employee's account, is not so long as to discourage the employee and make him feel, "What's the use of even counting that retirement plan as any of the tangible benefits that are received from the company."

Can Buy Life Insurance

A further provision allows the employee to use up to one-third of his vested interest in this retirement fund to purchase life insurance at any time he so desires. The only stipulation is that the life insurance shall be purchased by the trustee upon direction of the beneficiary from the company carrying the group life insurance of this company. This is done to prevent an influx of life insurance salesmen each year as the annual credit is made. Another stipulation is that only life insurance of a permanent type can be so purchased (thereby excluding such things as term insurance and so forth, which have no cash surrender value to the employee).

Retirement age is set at 65. At that age the entire amount credited to the employee's account will be paid over to him. If, before he reaches age 65, he dies or is permanently disabled, the entire amount will be paid. If he leaves his employment before he reaches retirement age, his vested interest will be paid to him in five equal annual installments.

An advisory committee to administer and to interpret the retirement plan, and to advise employees in the use of the funds thereunder, is composed of a duly elected representative of the employees who belongs to the union, a duly elected representative of the employees who does not belong to the union (stenographers, clerks, foremen), and the personnel director of the company. Decisions of the advisory committee in relation to the eligibility and the amount of benefits due to any employee are binding upon all parties.

Keeping Workers Informed

One thing not mentioned has been the method of keeping employees posted as to how the profit sharing plan is progressing.

It is most important that each month, just as soon as the books can be balanced and the net operating profit determined, the full amount credited to profit sharing of employees under the plan be posted, shown for that month and also the accumulative total for the fiscal period to date. In actual operation it is also advisable and extremely important that such items as lost time, scrapped material, and all the other things that mitigate against profits be shown at their true dollar value, and a discussion, either in bulletin form or in some form, be made as to just what percentage this amount bears to the earnings themselves—or, to put it another way, how much larger the earnings per employee could have been had there not been so much scrap, lost time, absenteeism, etc.

In our experience, employees watch for the monthly posting of these figures with a great deal more interest than they watch anything else. Our experience shows also that poor workers are automatically weeded out after being warned that they are not "playing ball," and that the entire group is most receptive to suggestions from management as to how productive processes can be improved, thereby creating more profits, and also that from employees themselves come all manner of good suggestions as to how profits can be increased.

To sum up, it is extremely important that management use every opportunity to discuss the problems of the business with its employees, and do it in the light of actual operating figures rather than in generalities. This creates more good feeling and teamwork than anything else possibly could create.

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BONUS PLAN

JAMES F. LINCOLN
President, The Lincoln Electric Company
Cleveland

James F. Lincoln got his electrical engineering training at Ohio State University, then went to work for Lincoln Electric Company, which his brother had founded. He is widely known as a champion of free American industry and as an opponent of bureaucratic domination. Author of "Lincoln's Incentive System." Lecturer on all phases of welding as well as on economic and political subjects.

WE HAVE had a bonus plan in operation in our company for some fifteen years. During that period, the output per man per year has increased more than 12 times.

What I mean by that is the amount of time spent by each individual to produce a product—and remember the product has remained the same—has been cut to less than 10 per cent of what it was 15 years ago. During that period, which has covered good times and bad, war and peace, we have never had to drop a single individual. It is true that during periods of stress we have shortened hours, but we have never had to reduce the number of men or reduce wages.

During that period, also because of the fact that the man was paid for what he did, we have been able to increase wages, to the point now where the men worked on our products have over the last few years averaged more than $5000 per year. Dividends to the stockholders have been continuous.

There are certain suggestions that might be of help in installing a plan like ours. The first is that a man must be paid for what he *does*, not for the amount of time he spends. I believe, thoroughly, that a man should be paid on piecework, because only so can you pay him for what he accomplishes.

To get this type of plan started and accepted by workers, the first thing to do is get a means of talking with the men. In our case we use what we call an "advisory board." This advisory board is made up of one man elected from each department by the people in that department. The foremen also elect a foreman representative, and the superintendents of the factories, plus myself, make up the board. Second, pay the men for what they can do. You can with this advisory board outline the plan to the people so they will understand what the program is.

If you are going to put in piecework you must be able to establish your piecework price on the proper method of doing the job. Management must first determine how the job is to be done, get it properly tooled, properly organized, so it knows what the man will earn, then pay him on that. Put the price where it should be. Under those conditions his earnings are going to reflect his ability.

Third, and most important, perhaps most difficult, you have got to find some way of having him part of the team. We do it by going to the man and saying: "Here is the job as it now exists. We are going to continue to reduce costs. That part is our job, but when the end of the year comes we are going to cut you in on what we have accomplished."

At the year's end, we pay dividends. We believe the wages of capital are just as much a proper charge as the wages of men. Next, we assure the progress of the company. Therefore, the board of directors sets aside enough money for this purpose.

The money that remains is then divided among our people on the basis of their contribution to the success of the year's operation. It goes from the bottom to the top. It happens in this particular case I am the one who determines who gets what, and I have always cut myself out. I have never taken a dollar.

One way to make the worker more conscious of the realities of the profit system is to make him a stockholder in the company. If he owns a part of what he is dealing with, he will have a still more enthusiastic point of view toward it than if he doesn't. About half the people in our company are stockholders in the company, not because we have tried to make them so. In fact, in order to buy stock they have to pay for it in one year. They also must get the okay of their superiors. We do not try to sell the stock to the men.

We have had no difficulty in controlling quality. A man has to guarantee his work. If the work is not up to standard, he has to make it good on his own time.

We started this system some 30 years ago. There was no union, of course, and perhaps our problem was somewhat less difficult than it would be at the present time with a union in a prominent position. We went to one man in a department and said to him: "We believe that you would be much better off if you worked on piecework. Would you like to try it?" He gave the usual objections—piecework is always objectionable to men—but he said: "Sure, I will try it." He was put on piecework. He almost immediately started to earn considerably more than he had before, and our difficulty from there in was not a matter of trying to get piecework put in. All the men in the factory immediately came back and said: "How is it that Whitey Baker can get a lot more money than we can?"

I said: "He is on piecework." "Why can't we go on piecework?" they asked.

That is the way we did it. What counts is always the attitude of mind of the individual.

We have only about a thousand employees, but every advance comes from within. Every job is there for the man who can win it. Under no condition will any favoritism be shown on that.

These are some of the principles on which we work and which make our plan work.

Finally, when a man begins to slow down we have a complete system of retirement, and the man will be retired on a pension.

COST SAVINGS SHARING PLAN*

WENDELL W. ANDERSON
President, Bundy Tubing Company
Detroit

Wendell W. Anderson was graduated from Yale in 1922. He has been president-treasurer of Bundy Tubing Company since 1929. Currently a director of Automotive & Aviation Parts Manufacturers and Detroit Trust Company. Civic activities include a directorship in the Detroit Community Fund, and trusteeships in the Automotive Safety Council, Children's Hospital, and Jennings Hospital, Detroit.

THE BUNDY COST SAVINGS sharing plan is not a profit sharing plan in that it has nothing to do with the earnings of the company, but is predicated solely upon the relationship between the sales dollar and the hourly wages that go into it. The worker's interest, therefore, is confined to only four figures:

1. The total amount of sales in a given month.

2. The total amount of hourly wages paid.

3. The total number of hours worked.

4. To bring it down to his individual share, the total number of hours he worked.

All the other elements in the operation of the business fall strictly on the shoulders of management, and it is up to management as to whether or not the company is making a profit. As a matter of fact, it is perfectly conceivable that the company could be losing money, but the savings in production cost still would be distributable to the workers.

The plan was accepted by our employees during the month of March, 1946, and made effective April 1, 1946. Two and one-half years have elapsed since the original installation of the plan, and although it is felt by members of management that our employees have not taken full advantage of the possibilities available to them, the results are very gratifying, and indicate that an all-inclusive plan, based on collective effort without directly pitting one employee against another, can be successful in achieving the desired result—namely, reduce cost by increasing production, thereby assisting in guaranteeing steadier employment, and eventually lower end unit sales prices to our customers.

The following are some of the results obtained during the past 2-year period:

1. Production has increased approximately 50 per cent.

2. Absenteeism has decreased approximately 50 per cent.

3. Grievance time has decreased approximately 47.2 per cent.

4. Labor turnover has decreased approximately 81.6 per cent.

5. Hundreds of suggestions from hourly employees for improvement of production methods have been submitted and acted upon.

6. Last, but not least, extra earnings to our employees have been: First year, 23.3 cents per hour; second year, 26.7 cents per hour.

This makes an average extra earning per hour of approximately 25 cents for every hour worked during the past two years, and amounted to approximately $462.51 the first year, and $532.77 the second year, or a total of approximately $1000 for each employee who worked the full scheduled hours during the two years under review. In dollars the company paid its employees $1,153,532 for the first two years under the plan.

One question that arises in people's minds is what would happen to the plan if our economy were on the downgrade. During the period in review, wages, prices, and demand have all been at a high level. What would happen if the reverse were true?

We have had one indication of what happens when the economy is on the downgrade. That was in the fall of 1947, when we had to lay off approximately 14 per cent of our payroll, because of a curtailment in securing raw material and in order releases from our customers. This condition continued for approximately 8 weeks. During this period the earnings of the employees who remained on the payroll were even slightly larger than before the layoff.

This, perhaps, is not a complete answer to the question, but at least is an indication. Enthusiastic as we are, we must reserve judgment on our cost savings sharing plan in terms of long-range operations.

This plan is based on certain major factors:

1. Accepting their level of production as representing 100 percent efficiency.

2. Including all hourly rated labor in the plan on a collective effort basis. This includes sweepers, truckers, set-up men, maintenance workers, and toolroom employees, as well as the so-called direct labor employees.

3. Determining a base period, and using it for arriving at the hourly rate cost and the sales dollars value produced and delivered to our shipping room as the basis for the plan.

4. Sharing by both the company and the employees in the savings on a 50-50 basis.

5. The company to continue to spend money for improvements and sharing with the employees, on a 50-50 basis, the savings that might accrue from these improvements.

6. Certain non-recurring labor charges to be excluded from the plans, such as: (a) Labor expended on capital equipment items; (b) overtime premiums; (c) night premiums; (d) inventory costs; (e) pay to trainees; (f) supervision on probation; (g) clerical on probation; (h) other items that might be considered such as jury service, sales trainees, and so forth.

7. Distribution of actual savings to the employees on the basis of actual hours worked, regardless of base rate or classification.

Aside from the very acceptable financial emoluments received by

*Classified by the Council of Profit-Sharing Industries as an *indirect* profit sharing plan

both the employees and the company, the greatest tangible benefit derived from the operation of the plan to date has been the tremendous effect on the morale in our shop. As evidenced by the substantial decrease in grievance time, our foremen and supervisors have been able to get back to the job of actually supervising. The workers themselves do not tolerate loafing and even see to it that management is doing its part in properly laying out their work.

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SHARE-OF-PRODUCTION PLAN*

A. J. WOODFIELD
Personnel Relations Supervisor, Continental Paper Company
Ridgefield Park, N. J.

Alan J. Woodfield went to New York University for his industrial engineering education. He worked for Beecher Falls Manufacturing Company, the Ordnance Branch of the U. S. Army, and Sylvania Electric Products before his connection with Continental Paper, where he is in charge of industrial engineering and personnel relations.

CONTINENTAL PAPER COMPANY inaugurated its "share-of-production" plan two years ago, with the full cooperation of the union. In the first month after the plan became effective, our employees, through increased productivity, increased their earnings 20.1 per cent. In the second month earnings went up 30.7 per cent. No one knows how much more employees may earn—the only limit is the productivity of men, management, and machinery, working as a team.

Technically, the share-of-production plan is not a profit sharing plan, but rather is a non-arbitrary principle for sharing with employees the production values out of which must come wage payrolls, all operating costs, and profits, if any. Employee earnings are not geared to, or contingent upon, net profits.

The plan is based on two homely truths:

1. *The only money a company can pay out is that collected from customers for goods made and sold.* This money must first be used to pay for the materials and supplies the company uses in manufacturing its product. Money left after paying for these materials and supplies is known as production values.

2. *Payrolls and production values rise and fall together; if production values can be increased, payrolls and individual compensation can be expanded automatically.* Extensive research has shown that for the United States as a whole, pay is proportionate to productivity, and payrolls are and have been a consistent and stable percentage of production values. Our own experience over a 5-year period was that payroll averaged 30.51 per cent of production values.

The company guarantees to its hourly employees 30.51 per cent of the production values that they, together with management and machinery, create.

Employees continue to receive their legal and contractual straight-time and overtime rates of pay on the established pay days. Additional shares of production earnings are computed and paid every 4 weeks. The computations and payments are fully explained to employees in a share-of-production statement.

At the end of each accounting period (every 4 weeks) the total production values are determined, and 30.51 per cent of the dollar amount of such values is credited to the employee's share-of-production account. Weekly payrolls are debited to this account.

If the credit is greater than the amount paid in regular wages, the difference is paid out as follows—one-quarter of the credit is placed in a reserve account, which is balanced out twice a year. The remaining three-quarters is divided. One-half goes into immediate cash payments to all employees; the other half is deposited in the pension fund.

Technically production values should be determined and share-of-production payments made not oftener than every 6 months, because of seasonal influences and certain other fluctuations. However, because we believe supplemental earnings should reflect employees' current efforts, we are making these payments every 4 weeks. The amount held in reserve is intended to offset possible fluctuations. When the wages paid in any period are greater than the share of production credit, then the difference will be met by the reserve account.

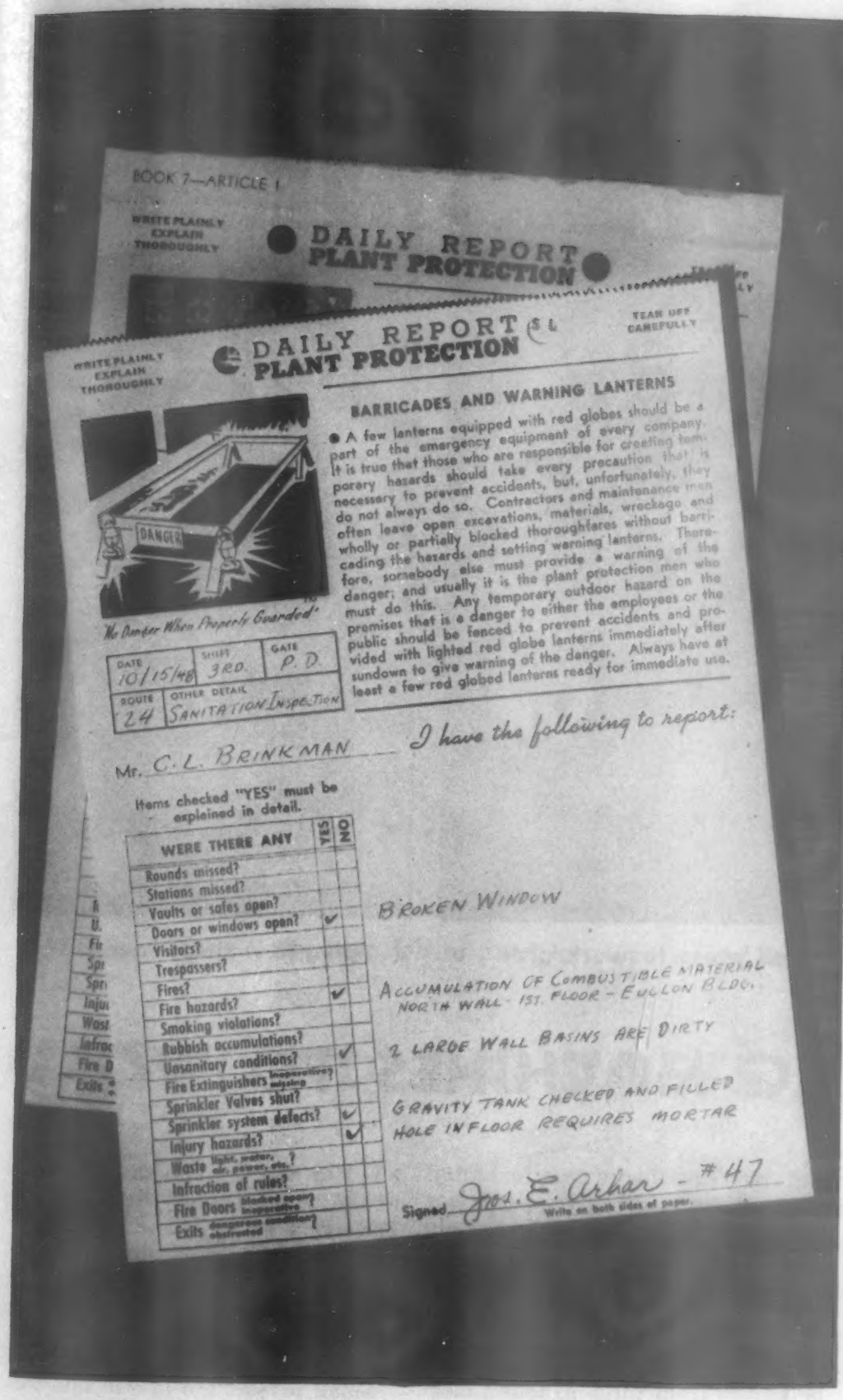
Twice each year, just before vacation time and Christmas, the reserve account is closed out. Any money remaining in the account is paid out, one-half in cash, one-half to the pension fund. If the reserve account shows a deficit, the company absorbs it, starting the account clear for the next period.

The amount available for cash distribution each period (and at the closing of the reserve account) is distributed to employees in proportion to regular pay previously received. For example, if the total cash distribution is $12,000 and the previously disbursed payroll is $103,000, then the supplemental payment represents 11.5 per cent of the total wages paid. Each employee, therefore, receives 11.5 per cent of his actual wages, including overtime, for the 4-week period.

Pension fund payments are allocated to the credit of employees in the same manner as the cash payments. The money is used to buy single-premium individual paid-up annuities, so that employees' guaranteed retirement income increases each time money is deposited in the pension fund.

The share-of-production plan is for the hourly workers of our company. Salaried employees receive additional earnings, over and above regular salaries, from a participating earnings plan. There is also a separate retirement plan for salaried employees.

*Classified by the Council of Profit-Sharing Industries as an *indirect* profit sharing plan



A "HELPFUL HINT" for every day in the year appears on the plant guard's report form at Parker. Each deals with something he should know about

EDUCATIONAL MESSAGES PROMPT PLANT GUARDS

Book a month. Page a day. Plant protection forms add short inspirational articles to routine checklist

PLANT PROTECTION PERSONNEL at the Cleveland plant of The Parker Appliance Company are required to make a report of all "out of order" items that they note during their rounds.

These reports are made on a commercial form which is furnished in pad form. A list of items that the patrolman should watch for on his rounds appears on the lower left and a space is provided for a check of any item he notices which is "out of order." On the right, in the lower half of the report, is a space in which he can explain what he found wrong. There is also a ruled space to show date, shift, gate, route and "other detail."

Daily Messages

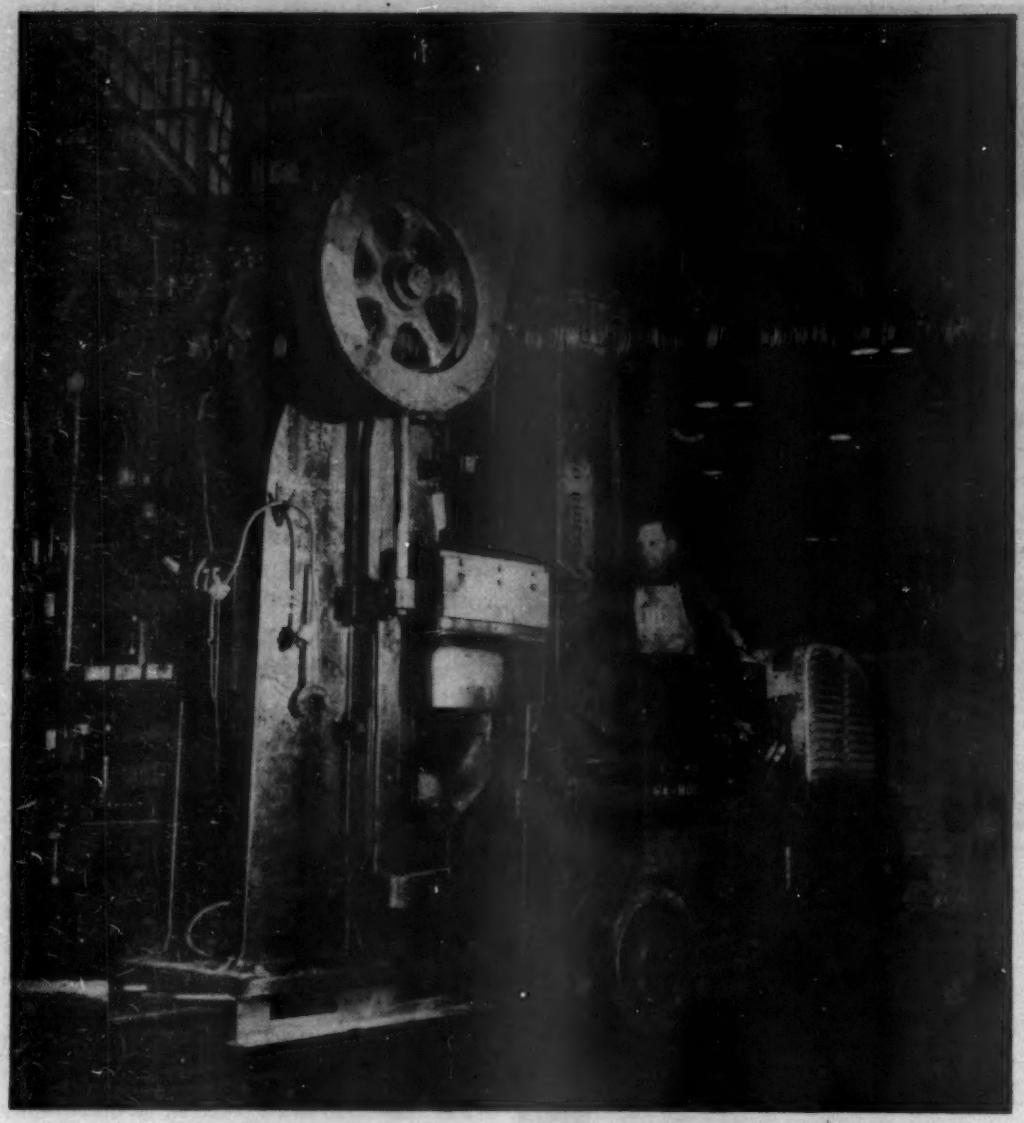
In the upper part of the report is printed a series of educational short articles. A new page is used for each day's report, and a different subject is covered on each page. All the articles are illustrated by simple black-and-white drawings.

In one book, marked "for use in winter," titles of the articles include the following:

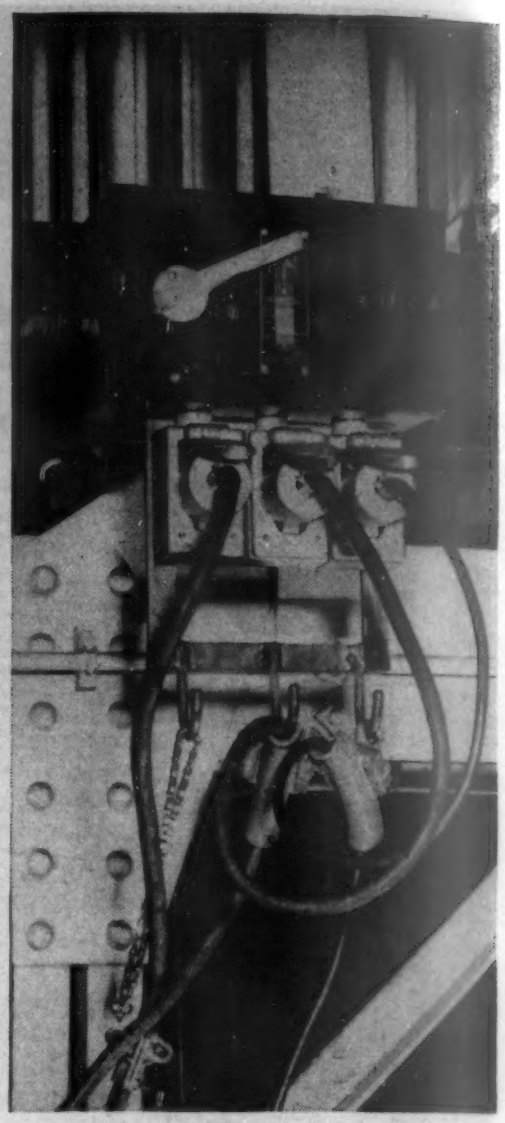
Barricades and warning lanterns; washing fire extinguishers; defective sprinkler alarms; a cordial handshake; hazards of vacant structures; ice formations on gravity tanks; the way to handle people; fire extinguisher failures; danger of portable lamps; some burglars use motor trucks; winter care of hydrants and hose; gas and fumes in low places; protection from an exposure fire; disposal of flammable liquids; operation of the fire pump; disposal of hot ashes; the way a sprinkler operates; temporary warming appliances; and committing unsanitary acts.

In a second book, for general use, the subjects covered are: When a fuse blows; dangerous cleaning fluids; when an accident occurs; sprinkler system water supply; exits that become fire traps; heat travels ahead of the flames; instructions on fire extinguisher inspection; metal clad fire doors stop fire spread; the explosive power of gasoline, paints, lacquers, and varnishes; spontaneous ignition; secondary water supply; fire hazards in rust-proofing; air leaks are expensive; adaptability of foam extinguishers; and inspection of ropes.

Through the use of these forms the guard not only has a quick, convenient means of making his reports, but also he is exposed to a great deal of useful information.



Fork truck moves pallet-mounted small press to work area . . .



. . . plug-in is simple and fast . .

MOVING MACHINES TO WORK

C. M. HIGHSTRETE • PLANT ENGINEER, AMERICAN SEATING COMPANY
GRAND RAPIDS, MICH.

MACHINES ARE MOVED to the work. not work to the machines, in the pressroom at American Seating. As a result, handling costs are down about 35 per cent and more than 40 per cent of the former floor space is saved.

Formerly, large presses of 215-ton pressure capacity were arranged in straight line. Considerable floor area was allowed between the large presses for materials storage, gondola boxes, and the like. As work was completed at the large presses, materials were moved by fork truck or trailer train to the smaller presses, located in another section of the pressroom. The small presses also were placed in a straight line so that materials could feed from one to the other.

There was considerable waste of floor area and excessive handling with this layout. Materials had to be moved from three to four times before the parts were completed.

The smaller presses are now mounted on steel pallets, so that they may be moved from one large-press area to another as each job is set up and run. No change in layout was required in the straight-line positioning of the large presses. However, almost all of the floor space formerly required for the small presses has been saved.

Large, counterweighted fork trucks now pick up the small presses and move them from job to job. When in position, they are plugged into an electrical duct system.

Work now flows from one large press to another and then directly to the small presses for finishing. The use of gondola boxes and trailer trains has been eliminated. Each part is now completed with a minimum of between-operations handling as well as with the utmost efficiency.

Small presses are moved into the large-press area for each job run, and from three to seven of them are ranged about the large press in sequence determined by the job being run.

Forms Ride Conveyor

The preliminary forms are made on compound dies in one of the large presses and then fed by gravity roller conveyor to one or more additional large presses for secondary finishing operations. From here, the parts feed to the smaller presses grouped around the larger presses. The operations are timed to permit the feeding of parts pro-

. . . special grouping for each job of fixed large press and movable small ones minimizes handling

CUTS HANDLING COSTS 35 PER CENT

gressively from one operator to another at each machine. *The pressroom has been put on a progressive, mass-production line basis.*

Press Easily Disconnected

When the job run is completed, the smaller presses are easily disconnected from their bus duct connection. The flexible rubber cable is wound around the machine and it is ready for moving. The large fork trucks then move into the area and pick up the punch presses to rearrange them for the next job. The change-over takes minutes, instead of the hours that used to be consumed before.

With the old type of layout in the pressroom, all presses had permanent electrical connections. When layout changes were to be made and presses moved, a group of highly skilled electricians had to disconnect all wiring before the press could be moved. This required almost a half an hour for two men. With the new type of electrical connections (plug-ins to bus duct system) it is possible to connect one of the smaller presses in less than 5 minutes. It is necessary only to put a ladder up, and turn the polarized plug-in socket. And, as an additional saving, the cost of wiring material is considerably reduced.

Four parallel bus ducts run the entire length of the pressroom. Two of the ducts, located on either side of the pressroom, are used for miscellaneous pressroom operations. The other two ducts, in the center of the pressroom, are used for the presses. Outlets are provided every 12 to 15 feet. There are three polarized outlet plugs at each switchbox on the duct. In many cases, depending upon jobs which will be run in that particular area, two or more switchboxes are provided to allow for connection of the maximum number of presses to be used in the area.

Each switchbox is provided with a 30-amp. fuse, and each outlet allows for a maximum load capacity of 7.5 horsepower. Large presses, with higher loads, are permanently wired directly into the power system. The power supply is 440 volts, three phase. Flexible rubber cable is used to connect the smaller presses to the bus duct outlet.

System Pays Off

This perhaps unique procedure of moving machines to work instead of moving work to machines is paying off at American Seating. Thousands of feet of materials handling transporting distance have been entirely eliminated. Handling costs are down, and floor space is saved. Expansion of pressroom capacity has been made possible. And efficiency is up, because materials now feed progressively.

CASES IN WORK SIMPLIFICATION

EMPLOYEES GO ALL OUT in making contributions to the better-methods program at Stewart-Warner Corporation's Chicago plant. They are encouraged to make work easier, reduce costs, improve quality, and lower overhead. They submit their ideas through the company's suggestion system. They benefit by having their jobs made easier and by producing at higher efficiencies. And they get substantial checks for their accepted suggestions.

Production men, engineers, and other members of the management group are expected to contribute to the better-methods program. Participation is inspired by management recognition. Many supervisors have already been rewarded.

The examples shown below were selected by a FACTORY field editor and Stewart-Warner executives during a review of plant operations.

ELIMINATED hand-operated arbor press used for swedging brass collar to speedometer drive core. Long chutes hold cores to prevent tangling. Operator places collar in fixture, inserts core to fixed depth where it activates switch controlling air operation of swedger. Results—production increased 20 per cent. Operator fatigue was reduced. Positive and clean swedges at the proper location are assured.

•

AUTOMATIC INSPECTION machine for brass odometer bushings utilizes phonograph turntable and standard pipe gage. Turntable forces bushings to tube feed (arrow) which leads to inspection gage. There, selector drops part into container for either good or bad parts. Results—bushings now receive 100 per cent length inspection instead of spot check. Automatic action of machine merely requires operator at nearby work station to load turntable. Job cost is substantially reduced.

•

AIR REPLACES HAND in conversion of a conventional hand-operated arbor press to an air-operated, foot-actuated press. Operation requires crimping cover and spring assembly on waterproof mechanism of motor mile odometer. The glass window must be crimped to the white, metal cover. Results—production has increased 42 per cent. Air operation assures uniform and constant pressure on the parts. Utilization of air pressure has reduced operator fatigue.

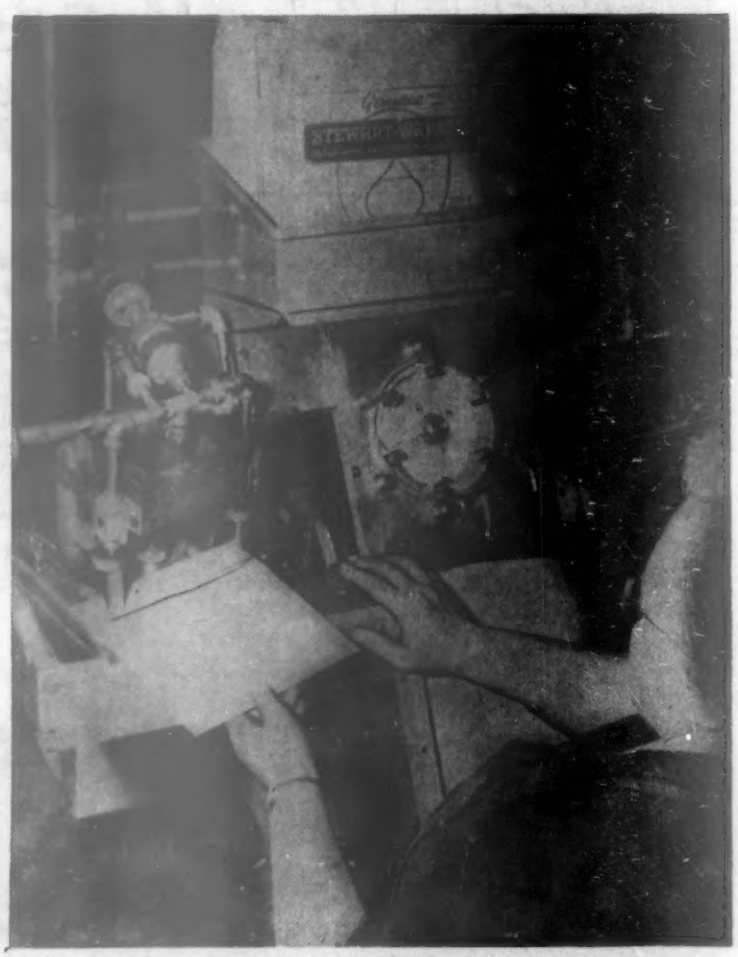
9. Stewart-Warner Corporation, Chicago

TRIMMING OF DIALS for odometer is now done automatically instead of by hand. Operation involves trimming of both outer edges of aluminum dial. Simultaneously, both sides of the dial hub are faced and chamfered. Wire brush on hopper (upper left) keeps flow to machine constant. Selector device centers dial as it feeds into trimmer to compensate for differences in hub length. Dial is automatically ejected to stock tray by chute. The old method of trimming these dials required three separate hand operations on a bench lathe. Results—production has been increased 127 per cent. Quality of the trimming operation has greatly improved. The work has been made much easier.

•

DIAL POLISHING is now done two at a time in a semi-automatic operation. Formerly the operator applied polishing compound to the glass dials and polished them one at a time. Now the operator simultaneously places two dials in plastic adaptors which fit over pins protruding from the worktable. These pins engage with a friction clutch when downward pressure is exerted on them. After placing dials in adaptors, operator applies compound, presses down on glass with polishing cloths, and the dials spin. Adaptors vary in size to accomodate dials of several sizes and shapes. They are removed by simply lifting them from the pins. Adaptor at left has been removed. Ducts at the rear of the bench were installed to remove the lint from the working area thrown off by polishing cloths. Results—production is up 43 per cent. Job quality has been improved. The job is easier for the worker.

•



COILING AND PACKAGING operations for the speedometer drive core have been greatly simplified. This operation involves coiling the core, inserting it in an envelope, and stapling the envelope. Operator hooks collar of the drive core in grooved pin and starts the pneumatically powered fixture rotating. While the core is being wound, the operator inserts the previous piece into an envelope and staples it shut. The double-stapling fixture is air-operated and is bench-controlled. The old method involved hand coiling, inserting, and sealing with tape. Results are impressive. Production was boosted 91 per cent. More than $2500 is saved annually by using staples instead of tape. A counter on the machine simplifies the task of getting an output record of units packed by the operator.

PATROL INSPECTION REPORT

PART NO.	ORDER NO.	DEPT.
117H-2903	216	A14
MACHINE NO.	**OPERATOR**	
B+S 2B	4-127	

TIME	SS	d	DISPOSITION
7:35	10	0	OK
8:20	10	0	OK
9:50	10	1	Tool Marks
11:00	10	0	OK
12:45	10	1	486 dim.
1:45	10	2	shut down
2:15	10	1	Reset on .486 dim.
2:45	10	0	OK
	10		
TOTAL	80	5	DATE 6-17
PER CENT DEFECTIVE		6%	SIGNED J.J.S INSPECTOR

FIGURE 1 Random samples of 10 each are checked by inspector. Third defect signals shutdown

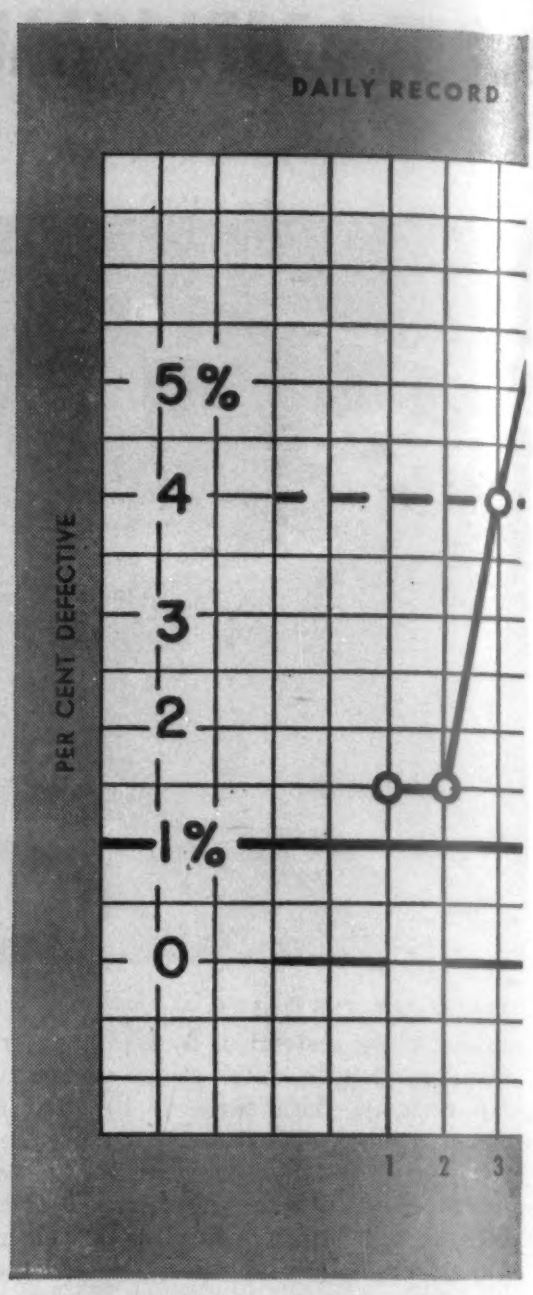


FIGURE 2 Percentage defective is calculated daily by

SIMPLE STATISTICAL CONTROL

C. W. KENNEDY • QUALITY CONTROL ENGINEER, FEDERAL PRODUCTS CORPORATION, PROVIDENCE

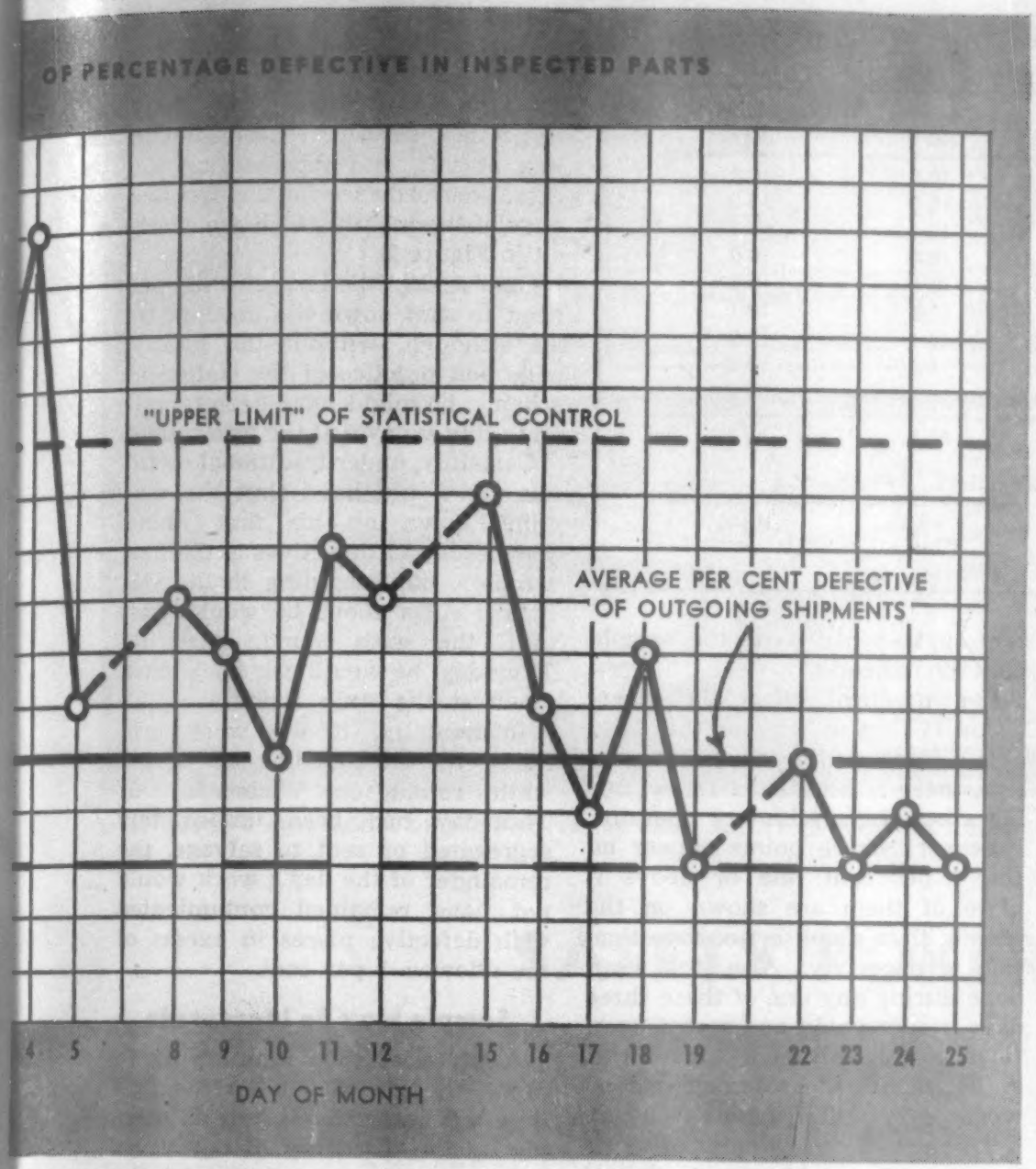
PATROL INSPECTION can be strengthened by introducing a bit of clerical routine flavored with a pinch of statistical quality control. The system in use at Federal Products is not a cure-all, but it neutralizes, at least, some of the errors formerly found in patrol inspection.

Because it is systematic, inspectors cover more machines more often. Best of all, however, we have realized definite reductions in scrap and rework plus rising production morale.

The plan was originally started in the screw machine department, where the patrol inspector covered some 12 machines. Shortly afterward the clerical and statistical features were added to patrol inspections in other parts of the shop, covering miscellaneous milling, lathe, drilling, boring, and grinding operations. Since a large variety of parts are made, the lots passing through machining areas vary in size from 5 to 5000 pieces, and, in the case of screw machines, to lots of some 20,000. Any one machine may break over into operations on two, three, or five different parts in a single day or a set-up may happen to stay put for a week or more.

The basis of the inspection control is a simple 4x5-in. card. One is kept at each machine or operation normally subject to patrol inspection, usually in a metal holder on the machine or over the bench. On the card is written the basic record of inspection action at each periodic patrol inspection visit. All the cards in a department are collected by the inspector at shift's end, summarized, and turned in.

On the card (Figure 1), the letters *SS* refer to sample size, which


OF PERCENTAGE DEFECTIVE IN INSPECTED PARTS
"UPPER LIMIT" OF STATISTICAL CONTROL
AVERAGE PER CENT DEFECTIVE OF OUTGOING SHIPMENTS
4 5 8 9 10 11 12 15 16 17 18 19 22 23 24 25
DAY OF MONTH

simply dividing total of samples inspected into number of defectives found. Result is posted daily to control chart at the machine

IN PATROL INSPECTION

is generally predetermined and printed on the card, becoming in effect instructions to the inspector. The sample, of course, is random, but the inspector exercises care to be sure it represents only the work done at the machine since his preceding visit.

Number Defective

The letter *d* is the number of defective pieces found in the sample, if there are any. Defectiveness includes any valid reason why the work does not conform to specifications or shop standards and practices. A piece may be judged defective and technically unusable in the succeeding process or in the product for a single reason or a dozen causes, such as gaged dimensions, taper or out of round, warped or crooked, tool marking, burrs or nicks, surfaces not cleaned up, operations missed, and so forth. *The main point is that the best record system is no substitute for the ability to measure and genuine practical knowledge of the inspector, as to what constitutes substandard work.*

At the end of the shift, the inspector adds up the *SS* and *d* columns. Either he or a clerk in the office calculates the per cent defective by dividing the total number of defective pieces found by the total number of pieces actually examined (d/SS = per cent defective). Decimal places are disregarded; per cent defective to the nearest half per cent is sufficient for our purposes at Federal (although this may not be so in some sampling plans).

Statistical Control

Now enters the so-called statistical quality control application. A simple chart prepared on ordinary ¼-in. cross section or graph paper, also is hung on the machine. Figure 2 shows a section of this chart, on which the inspector has plotted the daily percentages defective.

It can be seen at once that the chart presents a picture, probably not previously seen by the operator and his foreman in quite this light, of how the job is going in respect to quality. Almost inevitably, simply displaying a chart of this type seems to bring about improvement in scrap and rework and thereafter keeps it at a reasonable minimum. The evidence shows that by the fourth and fifth week the charted points (most of them, at least) are bumping along the zero line.

Designing a sampling plan for a particular application is frequently a problem for an expert, but the plan in use at Federal is one that can be used in many situations, and the reasons for its successful operation are not difficult to understand.

During the course of a day the inspector may have examined a total of 80 pieces—10 at a time—but the machine may have produced, say, 500 pieces. It is reasonable to presume that if he has uncovered a few defective pieces in the sample, more defective work exists in the main batch of work. Experience shows, in fact, that even though no defects at all appear in a sample, they can still be present but undiscovered in the work the sample came from. Or, all the defects in the lot may have turned up in the sample.

These conditions result from the "accident of sampling." And here is where the mathematician comes in. He is able to calculate the probable error in sampling.

The chart emphasizes the 1 per cent figure. Put as briefly as possible, it is anticipated the machine may allowably produce as much as 1 per cent defective or substandard pieces. On the whole, it is uneconomic, unnecessarily costly in time out for resettings, tool sharpenings, and the like, to require a machine to produce perfect work—100 per

Inspection Record for First Five Days Charted in Figure 2

Mon. SS d	Tues. SS d	Wed. SS d	Thurs. SS d	Fri. SS d
10-1	10-0	10-2	10-0	10-0
10-1	10-0	10-0	10-0	10-0
10-0	10-0	10-0	10-1	10-1
10-0	10-1	10-0	10-0	10-0
10-0	10-1	10-0	10-1	10-0
10-0	10-0	10-1	10-2	10-1
10-0	10-0	10-0	10-1	10-0
10-0	10-0	10-1	10-0	10-0
—-	—-	10-0	—-	—-
80-2	80-2	90-4	80-5	80-2
PERCENT DEFECTIVE				
1½%	1½%	4%	6%	1½%

cent within tolerance. The average industrial allowance for machining is 1 per cent. However the figure can be set lower or higher, depending on practical commercial requirements or the type of equipment. The National Screw Machine Manufacturers Association, for instance, suggests 5 per cent allowed defectives in commercial screw machine work.

Upper Limit

On the chart, also, is a horizontal dotted line at 4 per cent. This is known in statistical quality control as the upper limit for sampling error. Any point plotted on the chart represents the per cent of defective work appearing in samples only. So, the mathematician tells us—looking at the chart as a whole—that when any point falls between the base and 4 per cent line, the actual work that the sample point represents, very probably contains about 1 per cent defective pieces. Because of the accident or error of sampling this will be true even though the results of sampling may put the point on the base line, or as high as 3¾ per cent.

To put it another way, where the per cent defective in the day's samples turns out to be greater than 4 per cent—more than the upper control limit for the so-called sampling error—something more than the accident of sampling has entered the picture and the work represented by the sample is more than 1 per cent defective. One point on the chart shows a sampling per cent defective at 6 per cent. This means the work done that day contained more than the desired 1 per cent defective material, though perhaps not as much as the 6 per cent substandard parts the sample directly indicates.

The practical effect on supervision is that so long as the daily dots appear under the 4 per cent line, there is little need for worrying about the machine or operator. However, where points appear on the 4 per cent line or above it (two of them are shown on the chart), then some sort of investigation is necessary. Also, the work done during any one of these three days is segregated and sorted over, reworked, or salvaged. All the rest of the month the foreman had no worry over that machine's output.

There is one more point of value in connection with the statistical system added to patrol inspection. When an inspector is making his rounds he is continually beset with the necessity for deciding whether to shut a machine down or let it run on for a while longer—even though he may have found one or two defectives in the sample picked up from the last hour's work.

Assume that he will average seven, eight, or nine rounds per day, that he will have examined by day's end somewhere between 70 and 90 pieces. Four per cent of 80 (±10) is, in round numbers, 3 pieces. Four per cent (3 pieces), then, is the upper limit of sampling error. If, at any time of the day, the accumulation of defectives found in successive samples reaches 3, as shown on the inspection record card, the machine should be shut down and definite adjustments made. The reason, of course, is that if the machine is allowed to continue unchanged, more defectives will probably show up in subsequent samples, and a complete detailing of the day's work stands a 99 per cent chance of uncovering more than the allowed 1 per cent defectives.

Consider, for example, the daily inspection records reproduced in box at left, and representing the actual performance for the first five days of the month which are charted in Figure 2.

On Tuesday, the inspector did not need to shut down the machine at all although, without the knowledge and practice of the statistical scheme, he might have been tempted to shut it down at the fifth round.

Certainly, under traditional methods, he would have shut the machine down on his first round Wednesday (2 defectives in the first sample), but according to the statistical rules above he would wait until the sixth round. Also, on Thursday, he would ask for a shutdown at the sixth round.

Incidentally, if the work produced by the machine up to the sixth round on Wednesday or Thursday had been immediately segregated or sent to salvage, the remainder of the day's work would not have remained contaminated with defective pieces in excess of the allowed 1 per cent.

Sample May Be Inaccurate

A practical shop man trying to digest the idea above for the first time will instinctively protest passing up the discovery of defectives in any sample to wait and let the work proceed until some so-called "statistical" limit (3 defectives, or 4 per cent) has been reached. But he must remember that the system is based on permitting a practical level of defectiveness in the entire day's work, and that the report of any single sample is not necessarily accurate in disclosing the percentage of defectiveness actually existing in the entire batch.

We have found from the practice of the system just described that whenever an operation has swung definitely out of line, the sample and its statistical limit have sounded the warning bell in time, and that the day's batch has shown resident defects very close to the prescribed 1 per cent. Our former system of patrol inspection—without the statistical refinements—sometimes permitted work to get through which contained 5 to 20 per cent scrap or rework. And we have also found his operations stopped much less frequently from the overzealousness or misjudgment of inspector or operator.

601 -002
7791 Robert H. Frane 273-12-3127
1. One Weak Link Will Spoil the Safety Chain.
"SHOWDOWN" — Standard Register Co. — SAFETY DEPT.
601 -002
2. Safety Has No Quitting Time.
"SHOWDOWN" — Standard Register Co. — SAFETY DEPT.
4. Drive As If All Children Were Your Own.
"SHOWDOWN" — Standard Register Co. — SAFETY DEPT.
3. Little Injuries Often Lead to Big Infections.
"SHOWDOWN" — Standard Register Co. — SAFETY DEPT.
5. The Cost of Safety Is Only A Thought.
"SHOWDOWN" — Standard Register Co. — SAFETY DEPT.

SAFETY SLOGANS WERE PRINTED ON BACKS OF PLAYING CARDS. ABILITY TO QUOTE THE SLOGAN WHEN HE WAS ASKED GAVE WORKER $1 BONUS

SAFETY POKER

M. B. PITTMAN • SAFETY DIRECTOR, STANDARD REGISTER COMPANY, DAYTON

EMPLOYEES recently were encouraged to play poker at Standard Register. But it was a game called "safety poker."

This was an important part of a successful, 5-week safety drive. Announced by a special folder outlining rules and purposes, the "safety poker" campaign was participated in by all of the plant's 1500 Dayton employees. A perfect safety record was maintained during the entire program.

At the beginning of the week each member of the plant received an ordinary playing card with the week's safety slogan and his name, check number, and social security number imprinted on its back. Each week the names of all employees were put in a hat, and 50 were drawn. The safety director interviewed the first 25 individuals whose names came out.

Those who knew the week's safety slogan without looking at the card were awarded a cash prize of $1. A $1 bonus was given if the employee had the card with him when he repeated the slogan. If any of the first group failed to answer correctly, names were taken from the alternate list until 25 winners were found.

Contestants employed in departments where factory rules call for safety shoes, glasses, goggles, or other safety clothing earned a further $1 bonus if they were wearing prescribed safety shoes, and $1 more for having on safety goggles and glasses.

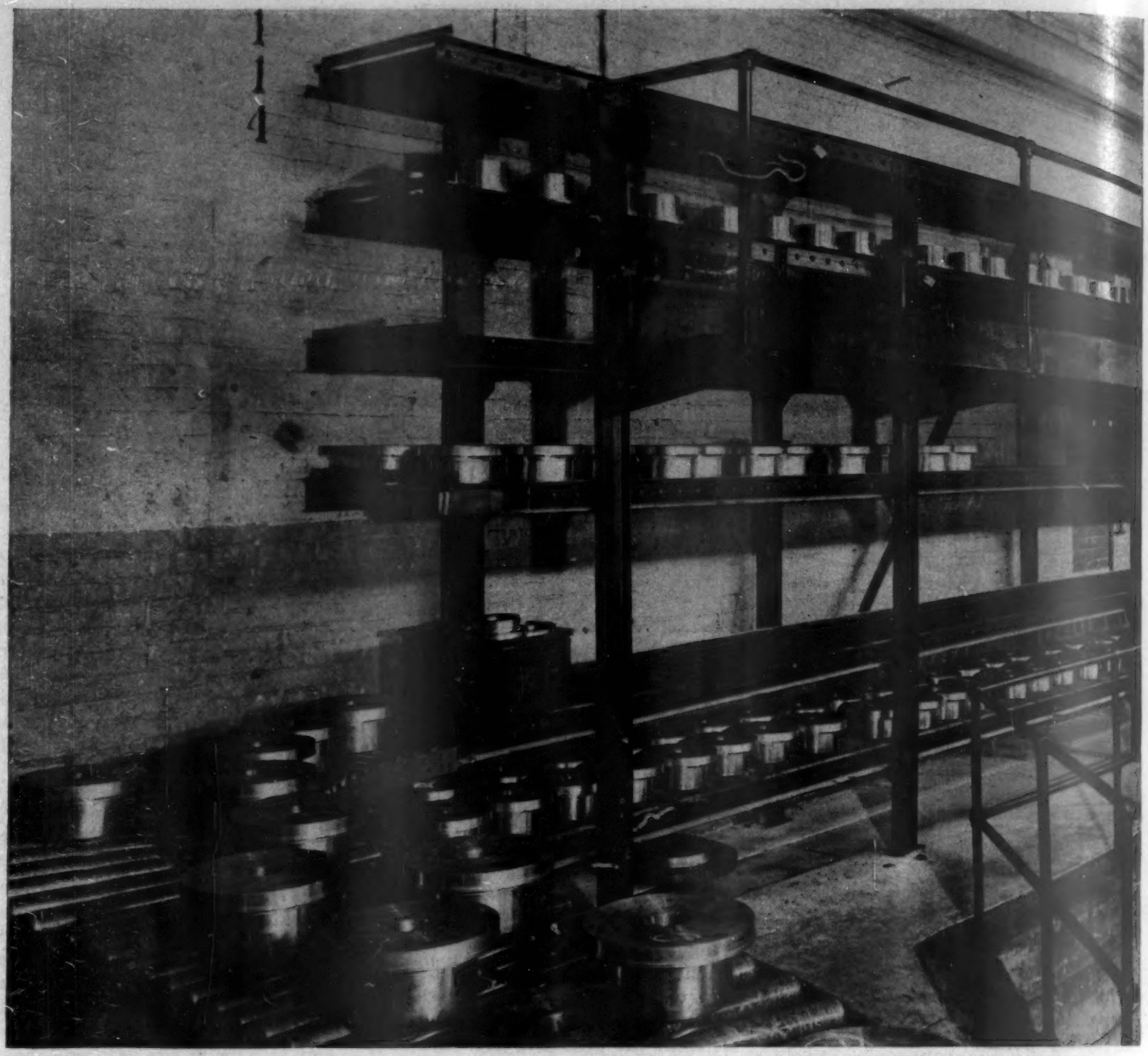
HIGHEST HANDS at end of contest won U. S. Savings Bonds or stamps

At the end of the contest, each employee had five cards—a poker hand. Those holding the three highest hands received U. S. Savings Bonds in denominations of $50 and $25, and $10 in savings stamps, respectively.

Along with distribution of the cards, special bulletin board safety posters were put up each week to keep interest of the employees at a high point.

The following was the cost of the entire operation—not too high a price to pay for a perfect safety record:

Playing cards	$60
Imprinting	70
Forty special posters	6
Announcement folders	200
Bonds and stamps	66
Weekly bonuses	300
TOTAL	**$702**



Couplings move from inspection along roller into space-saving six-tier storage section . . .

SIX-TIER CONVEYER FOR IN-PROCESS

HAROLD F. FALK • VICE-PRESIDENT AND WORKS MANAGER, THE FALK CORPORATION, MILWAUKEE

A SIX-TIER roller conveyor, installed late last fall at Falk Corporation has saved time and effort in the manufacture of couplings, and has resulted in lower production costs.

Storage of partially completed couplings between inspection and slotting operations tied up an appreciable amount of labor and space. After the couplings were inspected, they were loaded on skids and carried by shop trucks to the storage area. When the production schedule called for slotting, the couplings were loaded—either manually or by crane—from skids to the machine. The old method involved many crossings and recrossings of the shop aisleways.

In addition to the time that was spent loading, traveling, and unloading, there was a storage space problem in the shop because the old method required a large area of floor space at a considerable distance from the various machining operations.

The Improved Way

A gravity conveyor was designed and installed to carry the couplings from inspection, store them, and later transport them directly to the slotting machine. The conveyor was located at the point of

. . . elevator carries couplings to various levels, is operated by dual controls (in circles)

STORAGE SPEEDS OUTPUT

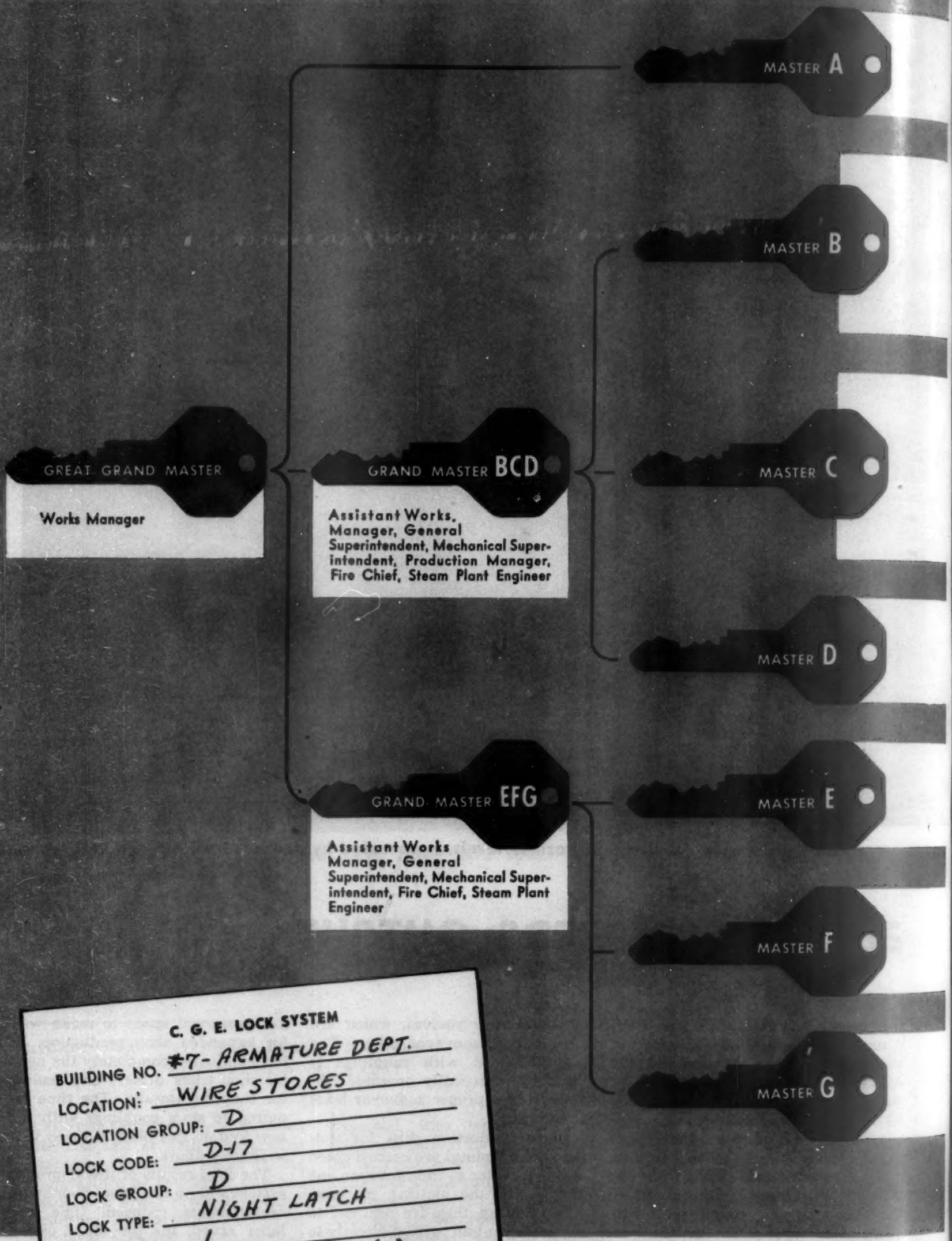
storage in the production line. With narrow conveyors on either end of the compact storage shelves, the conveyor needs a minimum amount of floor space against the wall.

The new coupling storage conveyor method follows a direct process. After the machine turning operation, the couplings go directly to the inspector, who checks them and places the couplings in the metal storage basket on the conveyor. The couplings then travel along the conveyor until they reach an elevator located in the middle of the storage shelves, which are also made of conveyor rollers. The basket loaded with couplings is lifted by electrically operated elevator to the proper conveyor level for storage.

When production calls for slotting, the couplings are carried down on the elevator to the conveyor line and on to the slotting machine. After slotting, they are returned to the conveyor and carried directly to the stockroom.

This coupling conveyor storage system, placed properly in the shop, has conserved space to make way for expanded shop production. It has eliminated completely the need for shop truck drivers and loaders for coupling storage. The time required to store couplings with the new system has been reduced to a negligible figure.

The final results of this improved system add up like this—floor space requirements reduced, time and labor saved, the job made easier, and materials flowing in progressive steps from operation to operation in the coupling department.



PLANT LOCK SYSTEM is set up to separate unrelated operating functions and restrict responsibility to employees and executives who

SETTING UP A PLANT LOCK AND KEY SYSTEM

It's the missing key that is wanted in a hurry. Here's a system that keeps tabs on 635 locks and keys

C. B. MUIR • PLANT ENGINEER, CANADIAN GENERAL ELECTRIC COMPANY, LTD. PETERBOROUGH, ONTARIO, CANADA

ORGANIZATION of the lock and key system may seem to be only a minor problem of the plant engineer. But disorganization of this important control of access to various units of plant property and assets can be a time-consuming irritation far beyond the effort to maintain a satisfactory system. In extreme cases of emergency the lack of a comprehensive system might spell unnecessary losses in property or life.

Second to the realization of the need for a good plant lock system is the care and anticipation with which the system must be set up. All too often a plant has embarked on a plan for key control that later was found inadequate for expansion, or required so many exceptions that it became ineffective.

There are many factors to be reviewed in designing a workable plant lock system. Who should be the key-holders? How shall single keys and master keys be distributed and controlled? What records to keep? Where shall the responsibility for custody of keys and records be centralized, for obviously administrative centralization is a prerequisite to good control.

Here at the Peterborough Works a system has been devised which is providing good control with a minimum of trouble and effort. The plant engineering department operates it. Other than the locks and the keys themselves, the entire physical equipment consists of a wood spare-key cabinet in the plant engineer's office and a card-file drawer nearby. The cabinet is locked with a key in the master system.

The diagram on these pages shows the scope and application of the plan. It covers approximately 30 mortised locks; 230 night latches, and 475 padlocks. All use the same cylinder-type key.

Allocation of the keys in each group were made on this basis:

Group A. Covers the cash sales department only, which handles all sales to employees. To place full responsibility on the supervisor and a staff, no other member of the company has a key other than the works manager through possession of the great grand master key.

Group B. All doors and gates that control entrance to the plant and grounds. It also includes all fire-doors and executive garages, which must be kept locked because they are outside the gates.

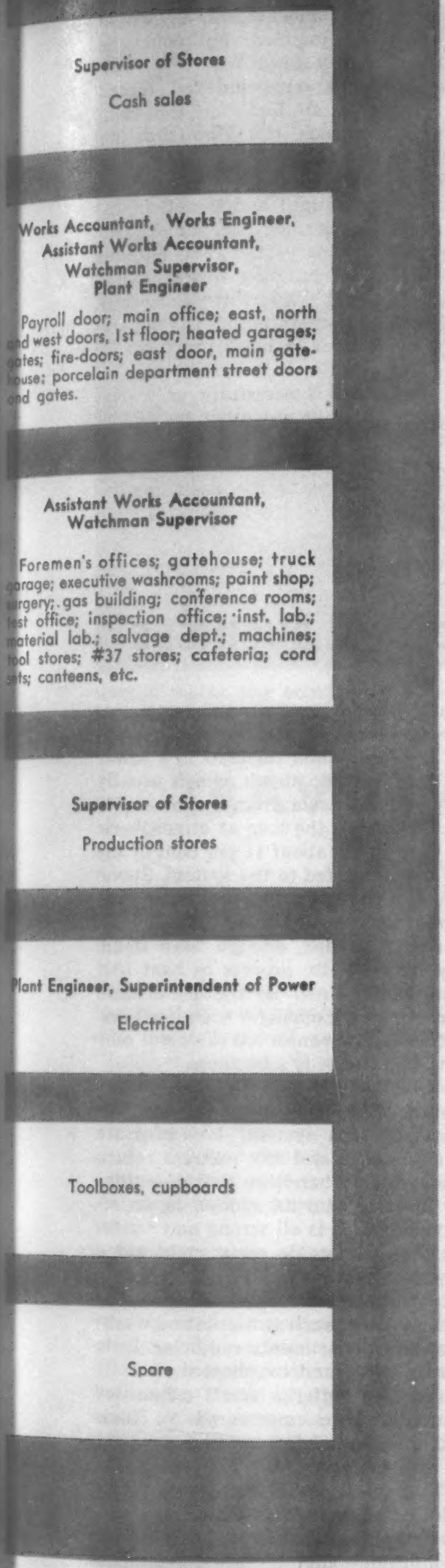
Group C. All locks of a miscellaneous character that do not qualify for any other group.

Group D. All stores that handle material concerned with the manufacture of the products, whether raw, semi-finished, or finished. Tool stores, however, are not in this group.

Group E. All electrical service equipment, such as control room, substation or test enclosures, control panels, and other electrical equipment that must be protected from public access.

Group F. All toolboxes, cupboards, etc., which might contain either company or employee tools. Employees are asked not to lock their private tools with other than a company lock. This request does not apply to small, portable toolboxes such as all toolmakers and good mechanics have. It does apply to stationary cupboards which are usually placed near the machine. Master F is used also for cupboards kept in all offices and in stores for holding miscellaneous supplies.

Group G. Held as a spare group. Locks and keys will not be ordered for this group until they are re-


Supervisor of Stores
Cash sales
Works Accountant, Works Engineer, Assistant Works Accountant, Watchman Supervisor, Plant Engineer
Payroll door; main office; east, north and west doors, 1st floor; heated garages; gates; fire-doors; east door, main gatehouse; porcelain department street doors and gates.
Assistant Works Accountant, Watchman Supervisor
Foremen's offices; gatehouse; truck garage; executive washrooms; paint shop; surgery; gas building; conference rooms; post office; inspection office; inst. lab.; material lab.; salvage dept.; machines; tool stores; #37 stores; cafeteria; cord nts; canteens, etc.
Supervisor of Stores
Production stores
Plant Engineer, Superintendent of Power
Electrical
Toolboxes, cupboards
Spare

hould assume it (above). Record of all company locks (left) is kept in plant engineer's office, cross-filed by department and lock number

quired. There is nothing to prevent the addition of other groups beyond "G" should they be needed.

All locks and keys are stamped with a code letter and number showing the master group and key number. Locks and keys are disbursed within the judgment of the plant engineering department, except for issue of master keys which must be approved by the mechanical superintendent. Since the maintenance department usually changes all mortise locks and night latches, it directs or is advised of all changes of location of these types. Padlocks are admittedly difficult to control. Only constant education and vigilance can prevent unrecorded changes of existing "system" padlocks.

All members who are given master keys must sign for them. Individual keys are issued without signatures, but usually allocated against the foreman or group leader.

Every lock is ordered from the manufacturer with three keys. It is more convenient to purchase extra or replacement keys from the manufacturer by code number as needed, rather than make them, because the source is close by.

When an individual key is lost, it is replaced either from the spares or by reorder. Spare keys are kept in the office cabinet according to the master group and code number.

Loss of a master key involves a problem not yet faced. In such event it seems likely a normal key replacement would be made. Change of a complete series of locks under a lost master key would rarely be justified, but could be made if necessary.

A simple, cross-indexed record is kept of all locks on the form shown on page 114. Two cards are filled in identically for each lock. One card is filed under the department (first line) and the other under the lock code number (fourth line). Formerly the first set was filed under building numbers, but as several departments occupy more than one building the departmental index is more practical.

This is the lock system that is functioning successfully at Peterborough. Like any other system, its efficiency depends not only on its simplicity but also on the degree of adherence to the basic regulations under which it operates.

DON'T LET STEAM WASTE BE NOBODY'S BUSINESS

DAVID MOFFAT MYERS · MYERS, FULLER & ADDINGTON
NEW YORK

ORDINARY, EVERYDAY STEAM WASTE in the average industrial plant is an item of needless operating expense. Steam is money, and with fuel going ever upward in price a little planning will pay a good return.

When a steam valve is opened, dollars begin to flow. The question is: Are you getting your money's worth out of those dollars?

If those dollars could actually be seen flowing through all the valves in your factory, would you not restrict their control to just a few persons?

When workrooms become too warm in the middle of winter, as they often do, someone opens a few windows without shutting off the radiators, and dollars go flying out the windows. It is just one of those things that is nobody's business and so, of course, it happens right along.

Steam traps are designed to prevent the escape of uncondensed (unused) steam. They are usually equipped with a bypass. Judging by the number of times the bypasses are found open it would appear that the average machine operator does not believe the steam is doing its work unless he can hear it whistling through the pipe, to tally a complete waste of every pound that whistles. But if it's nobody's business to guard against this very prevalent cause of waste, it's only natural for these dollars to escape. This waste applies to steam of even very low pressure, say 2 to 5 pounds. A diaphragm with a very small hole inserted in the bypass will help a lot.

When high-pressure steam of, say, 100 to 150 pounds, is used for processing in any kind of heating coils or radiation, not only may the type of waste occur that has just been described, but also a further loss occurs even when the traps are working perfectly and no bypasses are open.

When such a trap discharges its condensate, this water is the same temperature as that of the high-pressure steam. Therefore, when released to a lower pressure, some of it flashes into steam, which usually is lost. For example, condensate from steam at 100 pounds gage discharged from the trap at atmospheric pressure will flash into steam about 11 per cent of the total heat value of the steam fed to the system. Steam at 150 pounds gage will flash 21.5 per cent of its heat under the same conditions.

In one plant recently studied, enough flash steam was blowing away from 150-lb. process to heat half the buildings in the winter time. By the use of flash tanks and some form of heat exchanger such low-pressure flash steam often can be conserved to useful purposes. But it has to be somebody's business.

Another condition commonly found is the connection of high-pressure drips or even pump exhausts into the low-pressure return system. Low-pressure steam circulation is impeded and any vacuum return pump is placed under such a handicap that quantities of cold water are injected into its suction in an attempt to hold the vacuum. It is all wrong and wasteful, of course, but these things do occur right along unless watched by someone.

Many times steam to process equipment is not shut off during non-working hours such as nights and weekends, and buildings and departments requiring little or no heat frequently are found overheated.

If some one person, or better a small committee meeting once a month, were empowered to check on common wastes, a gratifying economy would result.

This committee's scope should include checking other utilities besides steam, such as water, gas, and electricity. A plant executive should attend meetings to see that the committee's findings are acted upon and the plant engineer should attend as adviser.

It will then be somebody's business, and you may be surprised to find what a good business it is.

WALK-IN TRUCKS HELP DELIVER MAIL TO DOW'S 375 BUILDINGS AT MIDLAND. SPECIAL RACKS SPEED THE DRIVER'S MAIL-SORTING JOB

TRAVELING POST OFFICE SPEEDS INTRAPLANT MAIL

WALK-IN TRUCKS and chain-store basket carts work together to expedite the delivery of mail at Dow Chemical Company, Midland, Mich. Mail is sorted by routes in the company's mailing department. Departmental sorting is done by the truck drivers. Basket carts are used to deliver mail to individuals and departments from the walk-in trucks.

Two large walk-in trucks, similar to those used for local milk delivery, are used to cover the 375 buildings on the company's Midland property. These trucks have been fitted with semi-circular mail sorting racks. Each of the "pigeonholes" in the sorting racks is identified by names of individuals and departments. This simplifies the sorting job. Each truck has its own designated route to follow. A 15,000 B.t.u. gasoline heater installed in each truck maintains a comfortable inside temperature regardless of the weather.

Mail messengers in the main office building are equipped with the basket carts. They simultaneously pick up and deliver mail throughout the building periodically during the day. They then deliver this mail over predetermined routes throughout the building. One cart is used on each floor of the two-story office building.

MESSENGERS, using basket carts, deliver mail to individuals

All outgoing mail is delivered to the walk-in trucks by the messengers for departmental and individual sorting. The trucks then proceed to deliver mail to the many other buildings on the extensive grounds.

Mail delivery and pick-up have been expedited at Dow Chemical since this system was started. Before, most of the mail was delivered by conventional methods. Messengers carried mail sacks over their shoulders and delivered everything on foot. This was time-consuming and fatiguing.

The results speak for themselves. Mail is being delivered in one-half the time required before. The number of mail messengers has been considerably reduced. Mail is delivered in much better condition than heretofore.

CONTROL CHART

FACTORY LOT NO.	STYLE	RUNNING NUMBERS	DATE ORDER ISSUED	DATE CUT	
17 NUDE MTL.	5F85G	15412-15451	9-10-48	9-17-48	
	ORDER NUMBER	QUANTITY	DATE COMPLETED TO FINISHING DEPARTMENT	DATE COMPLETED TO SHIPPING ROOM	
	305	40 DOZEN		1ST BUNDLE	2ND BUNDLE

SIZE	RUNNING NO.	S.M.S.F.	STOCK	BACK	SIDE	BELT	MEAS.	FINISHING DEPARTMENT	SHIPPING ROOM
	15412	9-23	9-29	9-28	9-27	9-27	10-8	10-15	10-23
2	15413	9-23	9-28	9-28	9-28	9-28	10-8	10-15	10-23
	15414	9-22	9-29	9-29	9-27	9-28	10-9	10-16	10-24
	15415	9-23	9-29	9-29	9-27	9-28	10-9	10-16	10-24
	15416	9-23	9-30	9-30	9-27	9-28	10-9	10-17	10-24
3	15417								
	15418								
	15419								
	15420								
	15421								
	15422								
4	15423								
	15424								
	15425								

CONTROL CHART shows location and status of each dozen garments in department. Sample indicates production and finishing are complete. Garments are in the shipping department. Chart is ready for analysis

SIMPLE CONTROL CHART IS KEY

How a garment manufacturer gets data for close scheduling of batches and control of in-process inventories

WALTER JENSEN • FACTORY SUPERVISOR, CHARIS CORPORATION
ALLENTOWN, PA.

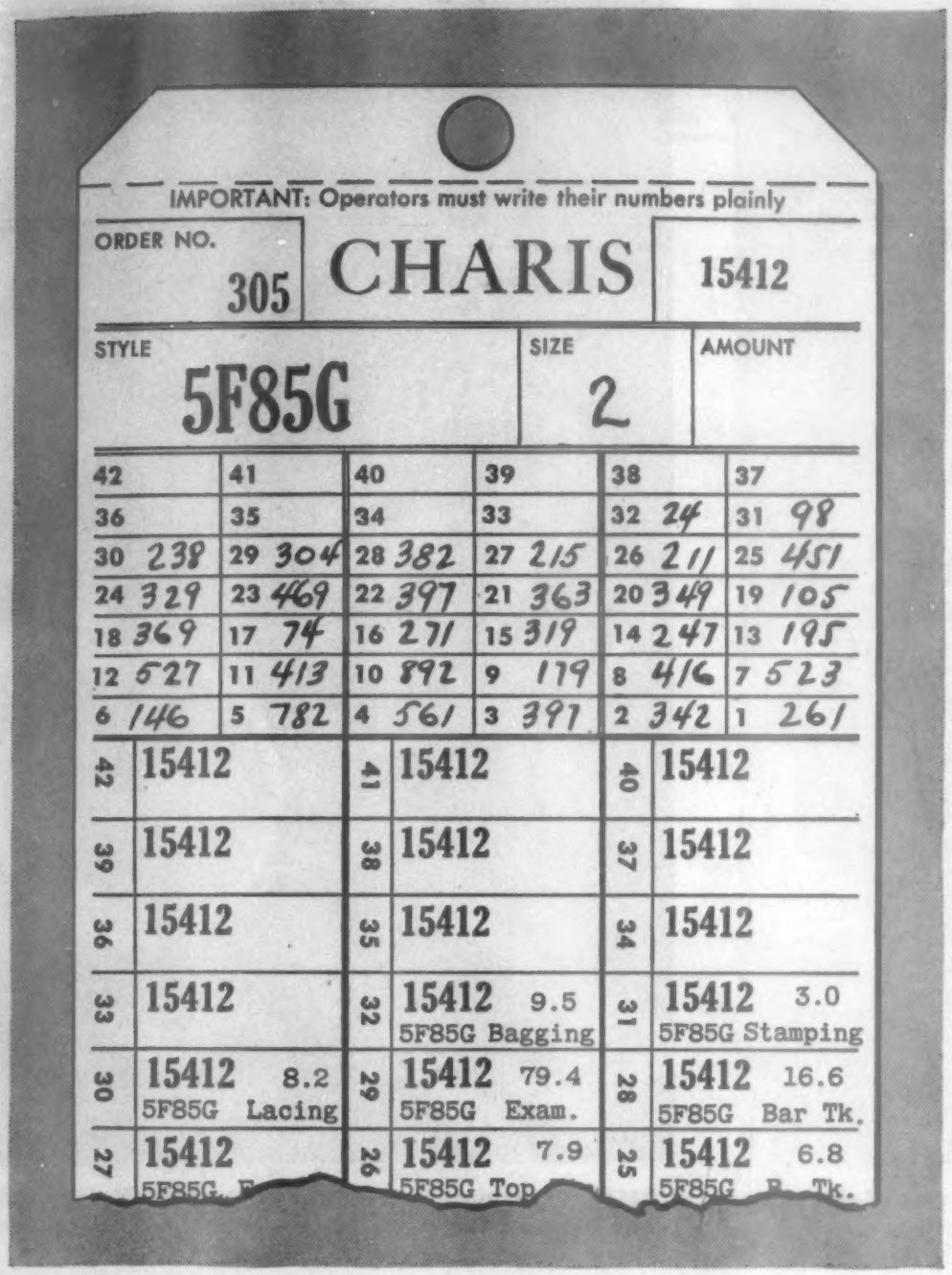
SIMPLIFIED PRODUCTION CONTROL became a necessity when the sales curve continued on the upswing at Charis. Bigger production schedules called for closer control of garment batches in the plant. Key to lower costs was better scheduling and handling of goods in process.

Management developed a simple, effective plan which accounts for an in-process inventory of almost 100,000 ladies' foundation garments monthly.

The control chart, shown above, is the heart of the plan. It is prepared by the production control department and sent with a cutting order to the cutting room where cloth for the garments is marked and cut according to pattern.

Running numbers are printed on each chart by a consecutive numbering machine. Each number represents a bundle of 12 garments. Size specifications appear in the far left column and apply to the running numbers they bracket.

Each bundle of garments is identified by means of a coupon ticket (see facing page) tied to it when sections of cloth comprising all the parts for the dozen garments are tied together in the cutting room.



IMPORTANT: Operators must write their numbers plainly

ORDER NO. 305 | CHARIS | 15412

STYLE 5F85G | SIZE 2 | AMOUNT

42	41	40	39	38	37
36	35	34	33	32 24	31 98
30 238	29 304	28 382	27 215	26 211	25 451
24 329	23 469	22 397	21 363	20 349	19 105
18 369	17 74	16 271	15 319	14 247	13 195
12 527	11 413	10 892	9 179	8 416	7 523
6 146	5 782	4 561	3 391	2 342	1 261

42	15412	41	15412	40	15412
39	15412	38	15412	37	15412
36	15412	35	15412	34	15412
33	15412	32	15412 9.5 5F85G Bagging	31	15412 3.0 5F85G Stamping
30	15412 8.2 5F85G Lacing	29	15412 79.4 5F85G Exam.	28	15412 16.6 5F85G Bar Tk.
27	15412 5F85G F	26	15412 7.9 5F85G Top	25	15412 6.8 5F85G B Tk.

COUPON TICKET is attached to each garment bundle. Sewer detaches coupon for pay credit. Operators' payroll numbers are in block at top

TO LOW-COST OUTPUT

Each coupon ticket has printed detachable coupons for as many operations as are necessary to complete the garments. When detached, these coupons become the basis for paying operators on piecework. As many as 42 separate operations may be provided for on each ticket. Thus, the same ticket identifies the bundle it is attached to from the time the material is cut until the completed garments reach the shipping room.

To simplify physical control, foundation garments manufactured by Charis Corporation are processed in various departments in the plant, such as bandeaux, brassieres, and girdles

The cutting orders are issued in consecutive order, regardless of the department to which they are routed. Therefore, in order to have the orders in each department numbered consecutively, a lot number is assigned to the cutting order and control chart. Each department has its own group of lot numbers running from 1 to 100, and standard practice is to first complete the orders that carry the lowest lot numbers.

Control charts are kept in numerical order by lot number in a chart file on the forelady's worktable. The forelady of a production department may have as many as 24,000 garments in her department at any one time.

All operators are at their workplaces for the entire day. Check boys carry the work from the bins to the operators, and *vice versa*. As each bundle passes through key operations, the check boy enters the date of completion on the control chart opposite the printed running number, which corresponds to a number on the bundle ticket. This procedure enables the forelady to detect whether any bundles of work are lagging behind the rest of the order.

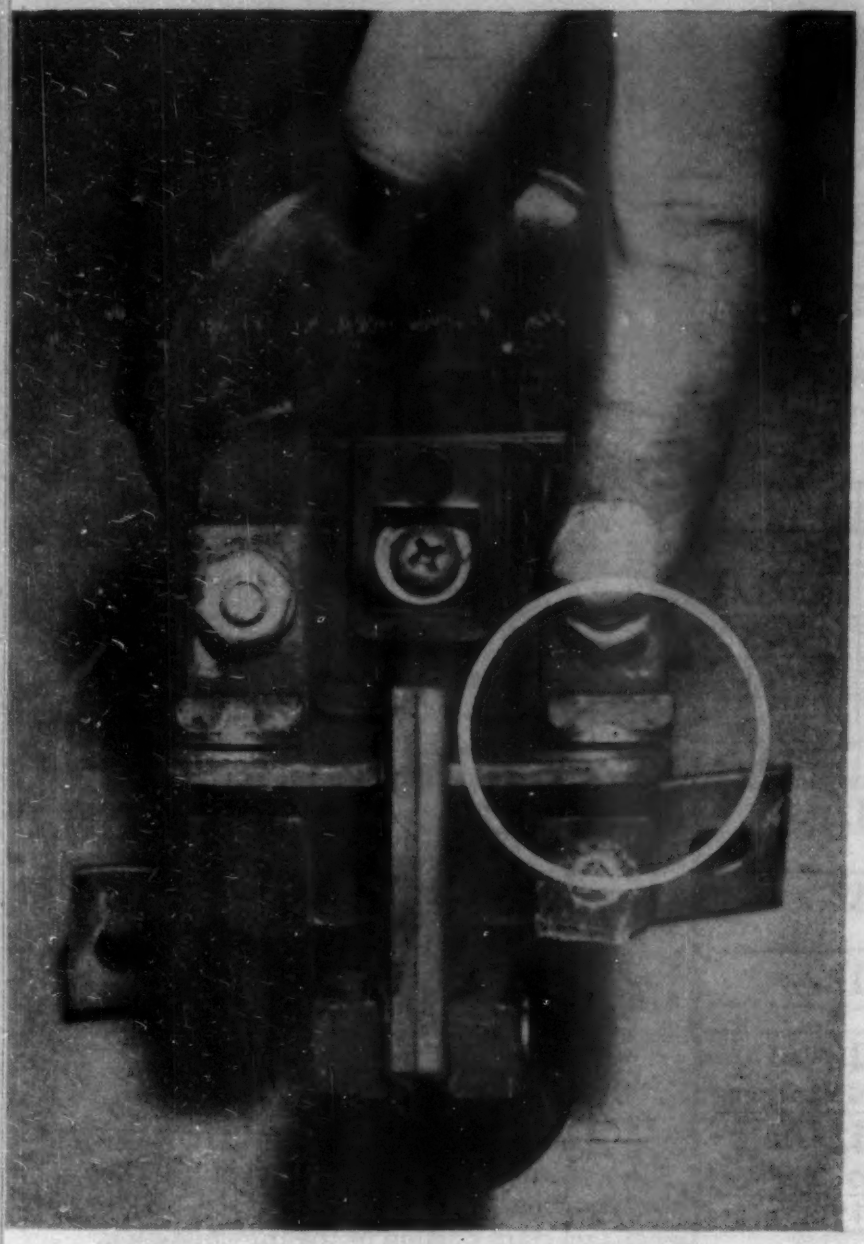
If so, she immediately gives them special attention until the cause for delay has been eliminated. By periodically checking the control charts, all bundles of work in one lot or order can be kept intact as they move through the factory to completion. After a bundle is completed in the sewing room, it is sent to the finishing department, where it is examined, bagged, and sent to the shipping department.

Control Chart Analyzed

When the last bundle in a lot reaches shipping, the chart is returned to the production control office, where it is analyzed and a certain portion of the information is transcribed to a production control summary sheet.

The purpose of these sheets, which are maintained for each style manufactured, is to supply the information needed on how long it takes an order of a particular amount and style to go through the cutting room; how long it takes the first bundle to reach the shipping room after the order has been released to the sewing room; how long it takes for the last bundle of work to reach the shipping room; and how long it takes for an order to go through the whole factory. This information makes it possible to forecast production with considerable accuracy.

In addition, each forelady prepares a weekly report of the number of dozen she has in process in her department, using the control charts as her source of information. This enables her to tell whether there is a sufficient amount of work in the department for the following week, or whether there is an overabundance of work which will require her to requisition more operators to get it out.



FAULT: A high spot on one of the contacts of this relay prevents them from closing simultaneously

REMEDY: Remove protrusions by drawing No. 00 sandpaper between the contacts. Do not file silver contacts

HOW TO CARE FOR TRANSFORMER TYPE A.C. ARC WELDERS

J. R. MORRILL • ASSISTANT TO THE VICE-PRESIDENT, THE LINCOLN ELECTRIC COMPANY, CLEVELAND

LEAVE WELL ENOUGH ALONE! That is a good general rule for the maintenance of a.c. welders. Because there are few rotating parts in an a.c. welder, wear is a negligible factor in their maintenance. A.c. welders can usually be depended upon to give years of trouble-free service without much attention.

A general hands-off maintenance policy implies, however, that the welder is built to withstand the strong mechanical forces imposed on it by the constant load fluctuations of welding. It implies, too, that the welder is properly installed, kept clean, and is not subjected to abuse. Also, that it gets whatever maintenance attention it does need.

The basic principles of current generation are the same in all transformer-type a.c. arc welders, but their construction varies widely. Manufacturers use different types of coil windings and insulation. Coils are placed differently, and the primary and secondary circuits are arranged differently. Methods of controlling output, starting the unit, and starting the arc also vary.

The following suggestions for the maintenance of a.c. welders will, therefore, be general. Specific maintenance schedules will depend on the construction of the machine under consideration.

Make sure that the welder is installed in a clean, dry location with provision for a continuous supply

Causes and Remedies for Troubles With A.C. Arc Welders

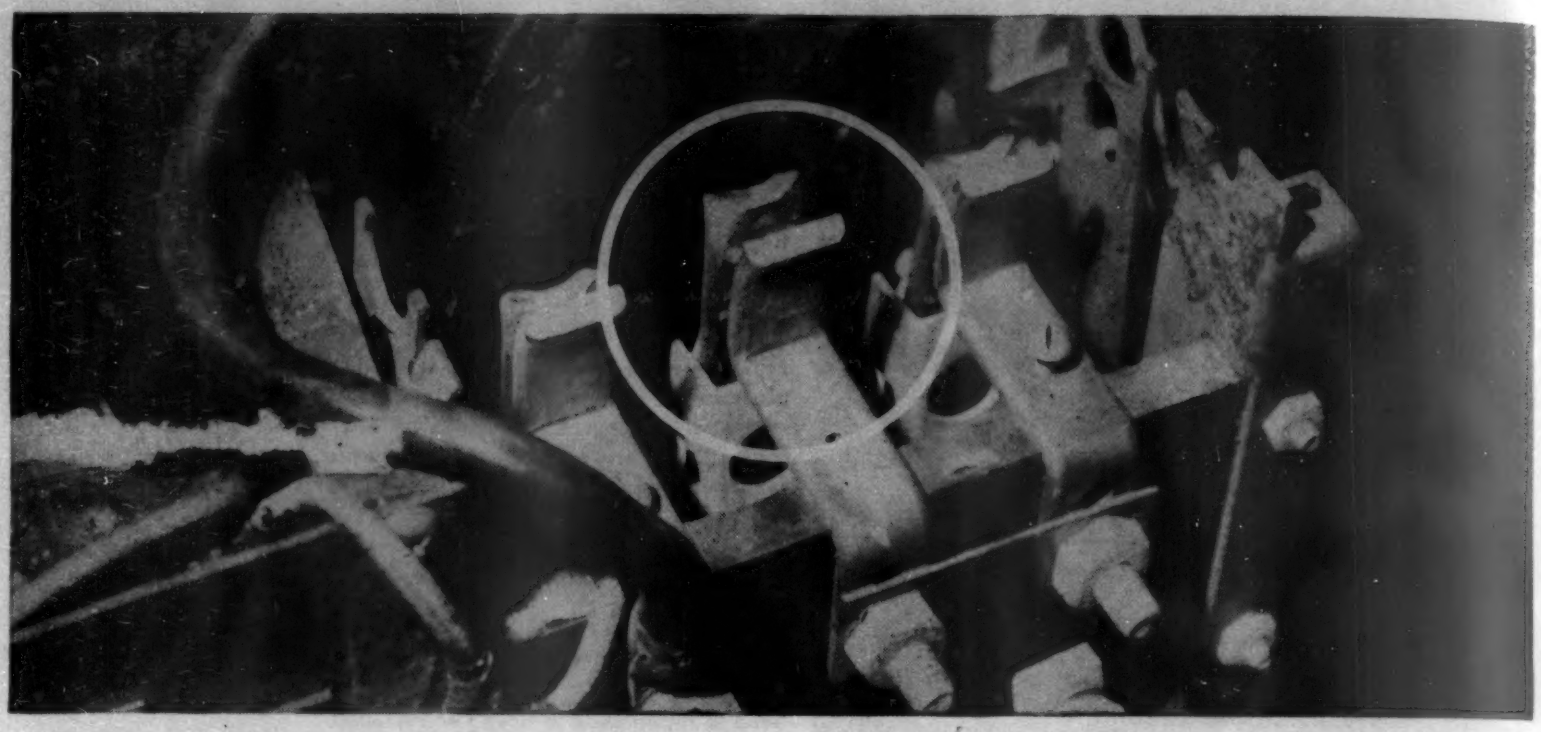
SYMPTOM AND CAUSE	*WHAT TO DO*
1. Machine fails to start *(Starter not operating)*	
Power circuit dead	Check voltage
Line fuse blown	Replace
Broken power lead	Repair
Wrong voltage	Check against instructions
Thermostat tripped (welder overheated)	Make sure that fan is operating and that there are no obstructions to free flow of air. Operate at normal current and duty cycle. To speed up cooling, hold in start button to operate fan but do not weld. This will keep fan operating
Starter switch jammed	Remove obstruction
No-voltage release coil open	Replace
2. Machine starts but will not weld *(Starter operating)*	
Electrode or ground lead loose or broken	Repair
Open transformer circuit	Send to repair shop to have coil replaced
3. Welder operates but soon stops	
Proper ventilation hindered	Make sure all case openings are free for proper circulation of air
Welder overloaded	Reduce welding current. Operate at normal current and duty cycle rating
Fan inoperative	Check leads and motor bearings. Fan can be tested on standard power line. Check voltage across leads with nameplate reading
High primary voltage	Check line voltage
4. Variable or sluggish welding arc	
Poor ground or electrode connection	Clean and tighten
Current too low	Check recommended current for rod size and type
Low line voltage	Check line. Some welders have an input connection for use when voltage is low
Welding leads too small	Replace with leads of proper size

CORRECT LEAD SIZE

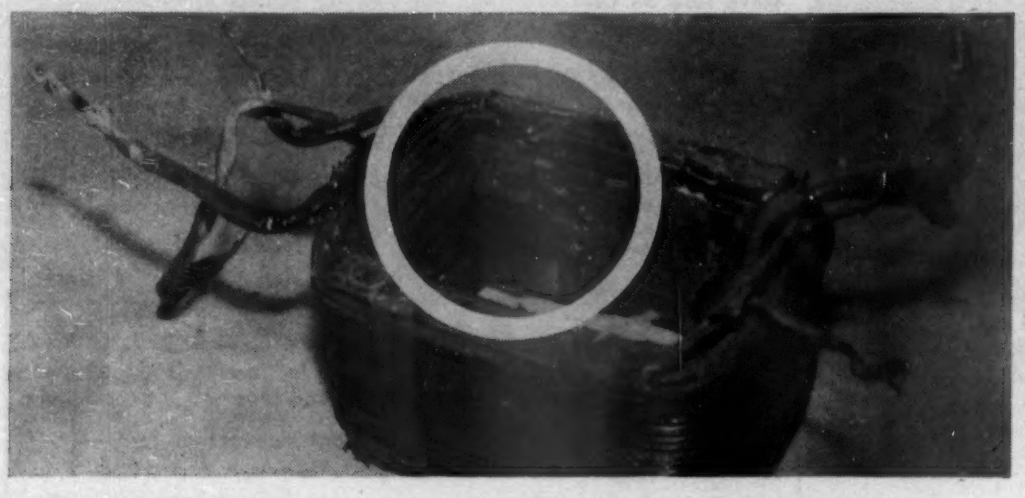
Welder Amps.	Cable Size AWG. for Length, Feet Up to 50	50-100	100-200
200	2	1	2/0
300	0	2/0	3/0
500	2/0	3/0	4/0

Electrodes too damp	Store in dry place, or dry out for 30 minutes at 230 deg. F.
Welding leads too long	Use larger cables or move work and welder closer together
5. Welder will not shut off	
Starter contact frozen	File contacts smooth and adjust fingers to make contact simultaneously
6. No Surge Booster Current	
Surge switch broken	Replace
One surge coil lead broken	Test different positions on switch. Repair broken leads
Dirty pilot relay contacts	Clean contacts with safety solvent
Surge control fuse blown	Replace and check for cause of fuse blowing
7. Surge Booster Current Maintains Too Long	
Delay-relay contacts sticking	Smooth contacts with No. 00 sandpaper
Surge current setting too high	Use next lower position of the surge switch

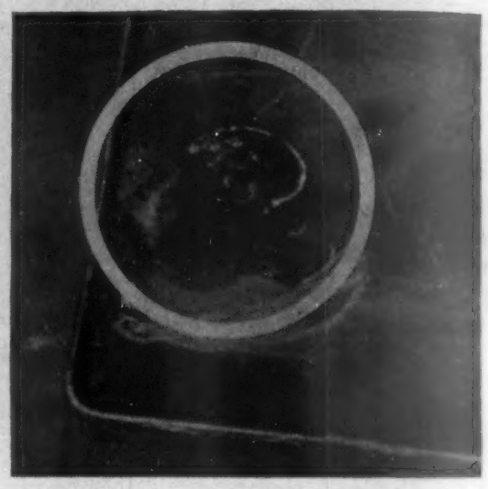
Three kinds of troubles that are caused by neglect or abuse of a.c. welders



STARTER CONTACTS must all close simultaneously. The middle contact of the three shown in this picture does not close properly Therefore it will arc and burn. Smooth deeply pitted copper contacts by filing lightly



COIL GROUNDED and burned open, either by allowing dirt to build up on and around it or by abuse in overloading. Insulation deteriorated and failed



CONDENSER GROUNDED at terminal by deposit of metallic dust

Sizes of Input and Grounding Cables for A.C. Welders

WELDER RATING, AMPERES	INPUT VOLTAGE	SIZE OF INPUT CABLES, AWG. (NOT MORE THAN THREE WIRES IN CONDUIT, OR THREE-CONDUCTOR CABLE)		SIZE OF GROUNDING CONDUCTOR, AWG.
		WITH CONDENSERS	WITHOUT CONDENSERS	
200	220	6	4	8
	440	10	8	8
	550	10	10	8
300	220	2	1	6
	440	6	6	8
	550	8	8	8
500	220	00	250,000 C.M.	2
	440	4	2	8
	550	6	4	8

of fresh air. A separate enclosure should be provided if the atmosphere is excessively moist or corrosive. Windings are insulated and impregnated, but the insulation will deteriorate from overheating and exposure if proper care in installation is overlooked.

Check the Power Supply

Alternating-current welders require single-phase power, but may be operated from a single-phase, two-phase, or three-phase line of the same voltage and number of cycles as shown on the nameplate. Before connecting the welder to the power line, however, it is well to consult the power company, to make sure that the power lines are of the proper capacity. The value of the required input current usually is given on the nameplate of the machine.

It is important to ground the case of the welder to a water line or other good ground connection.

The table on the facing page will serve as a guide to the proper size of input and grounding cables to use for safe operation. However, local ordinances may specify sizes other than those listed.

A welder should not be operated out of doors without protection against the weather, nor should it be operated in locations where the ambient temperature is high.

Welders are not recommended for continuous-load duty. The duty cycle for which the machine is rated is marked on the nameplate. Operation on continuous duty at more than two-thirds of the rated capacity will overload the unit. For example, operation of a 300-amp. welder on continuous duty at more than 200 amp. will cause overloading.

Use of excessively high current for welding operations will also overload the unit. The nameplate capacity is the maximum duty for which the welder is designed. Therefore, a 200-amp. welder should not be used to do the work of a 300-amp. unit.

An overload, if continued long enough, will result in burned-out coils unless the machine is protected by a thermostat. Overloading causes overheating, which dries out and burns the insulation around the coils.

Carelessness in making connections to the output terminals of the welder will not only damage the studs by arcing and burning, but also will result in an unsteady welding arc. The operator should make sure at the beginning of each shift that the welding cable connections are tight.

The electrode holder, or the electrode, must never be left grounded to the work, because this will cause a dead short circuit in the machine and excessively high current flow. The result will be a coil burnout.

Dirt must never be allowed to accumulate in the welder. Dirt that is allowed to collect on the contacts of the relays will damage them. Metallic dust may cause a short circuit in the internal wiring or become lodged in the winding insulation and cause a ground. Excessive dirt also may jam the current controls. Clean the unit regularly by blowing out all dirt with compressed air at a pressure of not over 30 p.s.i. Higher pressure may damage the windings.

Mechanical abuse, such as dropping or hitting the set, may cause internal as well as external damage. Controls are precisely aligned in order to maintain a balanced mechanical airgap. An unbalanced airgap will cause severe vibration. Damage to windings also may result from abuse.

Scheduled Maintenance

Because so little maintenance is required for a.c. welders, the general tendency is to disregard completely any regular schedule for a preventive check-up. The following is suggested as a suitable schedule:

Once every six months remove the external case, or top, in order to make a visual inspection and the following preventive maintenance checks:

1. Clean the welder thoroughly by blowing off accumulated dirt with compressed air.

2. Check all electrical connections for tightness.

3. Inspect all assembly bolts and tighten where necessary.

A. Control Mechanism

1. If the unit is a plug-in type machine, check all taps for possible loose connections.

2. Lubricate open-type bearings.

3. Paint quadrant chain with graphite grease if it has become dry. Any heavy grease will do if graphite is not available.

4. If control shaft rides through graphite-impregnated bearings, oil lightly.

5. See that fiber linings of brake cones are free from grease and dirt.

6. Adjust tension on control mechanism if operation has become too easy, or if welder does not remain fixed at one setting during operation.

B. Fan

Check the fan for free rotation. Do not lubricate bearings unless called for by the manufacturer. Many fractional-horsepower motors have sealed bearings.

C. Relays

Check the manufacturer's instructions before attempting to adjust relays. The normal position of relays may be either open or closed. Silver contacts should never be filed, but may be cleaned by pressing a cloth soaked in a safety solvent between them. An accumulation of dirt on contacts may make the relay inoperative. Because a silver contact is black, however, does not mean that it needs cleaning. Silver contacts soon form a black oxide which is a good electrical conductor and should not be removed. Any roughness of the contacts caused by sticking may be taken off by rubbing lightly with No. 00 sandpaper.

The same grade of sandpaper may be used to clean contacts of other materials.

D. Condensers

Never touch the terminals of condensers without first disconnecting the machine and shorting out the condensers by directly connecting the terminals. This may be done with a screwdriver that has an insulated handle. Condensers are used in the welder to improve the power factor. Failure of any condenser will not always be apparent. The majority of condensers will, however, either buckle or exude the dielectric when they blow out. Failure of condensers will make the input current more than normal.

E. Starting Switch

If the machine is equipped with a magnetic starter, inspect it thoroughly to make certain that the contact fingers are aligned so that all meet simultaneously. See that all connections are tight. Clean the switch and file the copper contacts lightly if they have become deeply pitted.

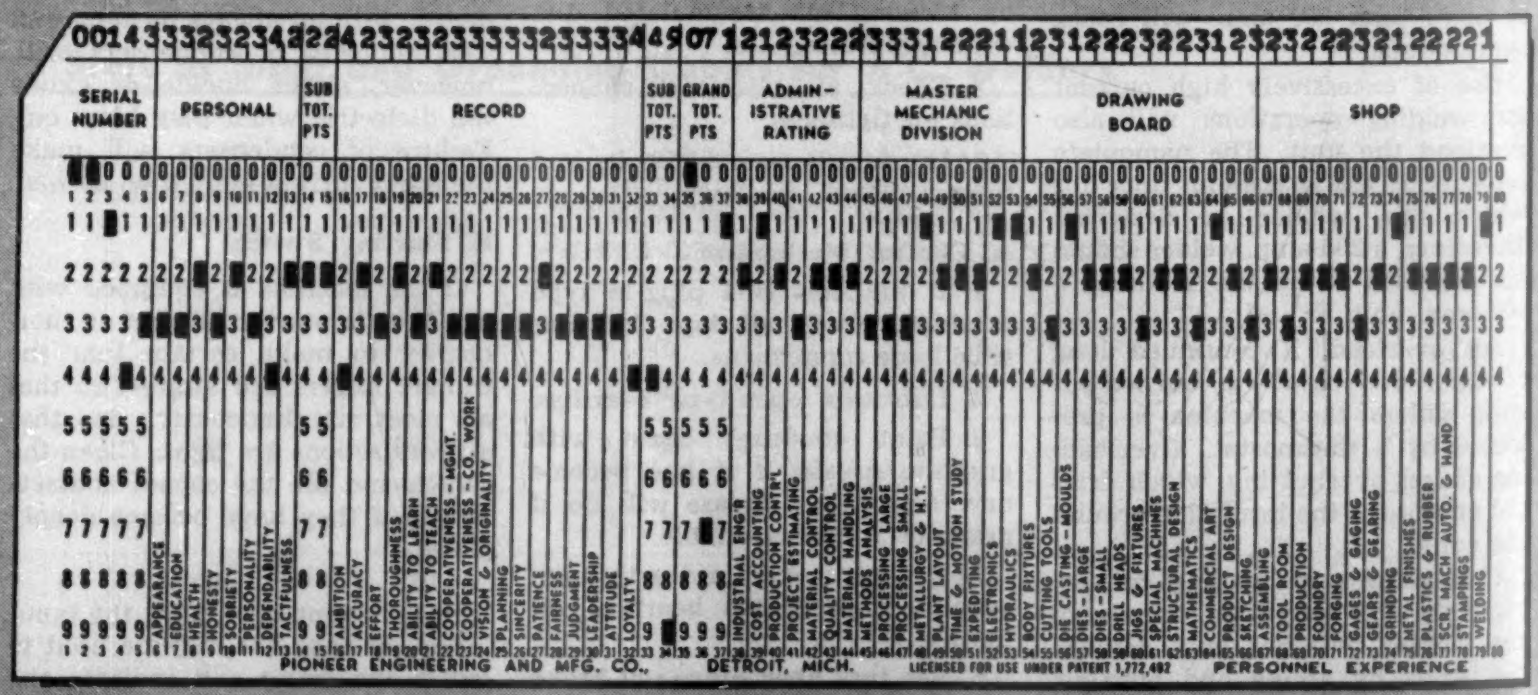
In the event of trouble, the tabulation on page 121 may be used to locate the cause and indicate the remedy.

EXPERIENCE RATING CODE { 0 Negligible; 1 Below Average; 2 Average; 3 Above Average; 4 Exceptional

PERSONAL	0	1	2	3	4
6 Appearance				✓	
7 Education				✓	
8 Health			✓		
9 Honesty				✓	
10 Sobriety			✓		
11 Personality				✓	
12 Dependability—Reliability					✓
13 Tactfulness			✓		
14, 15 Subtotal Points					22
RECORD	**0**	**1**	**2**	**3**	**4**
16 Ambition					✓
17 Accuracy			✓		
18 Effort				✓	
19 Thoroughness			✓		
20 Ability to Learn				✓	
21 Ability to Teach			✓		
22 Cooperativeness—Mgmt.				✓	
23 Cooperativeness—Co-worker				✓	
24 Vision and Originality				✓	
25 Planning				✓	
26 Sincerity				✓	
27 Patience			✓		
28 Fairness				✓	
29 Judgment				✓	
30 Leadership				✓	
31 Attitude				✓	
32 Loyalty					✓
33, 34 Subtotal Points					49
35, 36, 37 GRAND TOTAL POINTS					71
ADMINISTRATIVE RATING	**0**	**1**	**2**	**3**	**4**
38 Industrial Engineering			✓		
39 Cost Accounting		✓			
40 Production Control			✓		
41 Project Estimating				✓	
42 Material Control			✓		
43 Quality Control			✓		
44 Materials Handling			✓		

MASTER MECHANIC DIV.	0	1	2	3	4
45 Methods Analysis				✓	
46 Processing Large				✓	
47 Processing Small				✓	
48 Metallurgy & H. T.		✓			
49 Plant Layout			✓		
50 Time and Motion Study			✓		
51 Expediting			✓		
52 Electronics		✓			
53 Hydraulics		✓			
DRAWING BOARD	**0**	**1**	**2**	**3**	**4**
54 Body Fixtures			✓		
55 Cutting Tools				✓	
56 Die Casting—Molds		✓			
57 Dies—Large			✓		
58 Dies—Small			✓		
59 Drill Heads			✓		
60 Jigs and Fixtures				✓	
61 Special Machines			✓		
62 Structural Design			✓		
63 Mathematics				✓	
64 Commercial Art		✓			
65 Product Design			✓		
66 Sketching				✓	
SHOP	**0**	**1**	**2**	**3**	**4**
67 Assembling			✓		
68 Tool Room				✓	
69 Production			✓		
70 Foundry			✓		
71 Forging			✓		
72 Gages and Gaging				✓	
73 Gears and Gearing			✓		
74 Grinding		✓			
75 Metal Finishes			✓		
76 Plastics and Rubber			✓		
77 Scr. Mach.—Auto. & Hand			✓		
78 Stampings			✓		
79 Welding		✓			
80					

Comprehensive list of personal and mechanical abilities on employee rating chart...



...is transferred to punch cards to speed choice of qualified personnel

ACCURATE PERSONNEL SELECTION BY PUNCH CARD SYSTEM

A. M. SARGENT • PRESIDENT AND GENERAL MANAGER, PIONEER ENGINEERING & MANUFACTURING CO., DETROIT

ASSIGNING THE RIGHT MAN to the right job is the key to successful operation. We feel that we have developed a system here at Pioneer which guarantees 100 per cent accuracy in selection.

When a man is being hired for a particular job, matching of qualifications and requirements is not difficult. But when a man is sought from among present employees to handle a certain assignment, it is easy to overlook someone who may be exceptionally well qualified, simply because he was originally employed to do something else.

We found that most existing personnel record systems were designed primarily to record an employee's merit rating on the performance of one specific job and were chiefly useful in upgrading. We wanted a system which would indicate a man's personal characteristics and talents, and at the same time be free of all emotional influences.

The Pioneer staff spent three years in the development of a system which would prove satisfactory in all respects. We have used this system now for nearly four years, and, therefore, have had ample opportunity to test it.

The system involves extensive use of our tabulating equipment. This permits us to carry out the selection process mechanically and objectively so that the name of the man is not known until the choice has been made.

One of the most important things in making an assignment is to find the man with the best combination of personal qualifications and experience. A man may be rated as an expert in the technical field and still lack certain personality traits that would make the difference between success and failure. We have found that by grouping certain experience ratings together with specific personal characteristics, we were able to assign the man in our organization best fitted for the task.

Each selection is reviewed by a minimum of five men, following a logical appraisal by a skilled observer. This brings into the picture a system of checks and balances, another assurance that prejudice cannot control the selection.

So far, we have discussed what the system accomplishes. Now let us look at the mechanics.

Three separate forms are used, but in reality they are adaptations of one general form and provide for the recording of the same information but to be used for different purposes.

The words and terms used on the forms have been carefully selected in order to bring forth the best possible evaluation. The experience rating code words are: Exceptional, above average, average, below average, and negligible. Since the first rating of experience is made by the employee, it is important that words be used which will prompt him to judge himself rightly. For example, in the mind of the appraiser the word "average" in this system means "fair"; "negligible" is interpreted to mean "poor." We want to know if a man has had even the smallest amount of experience in a given area and feel that had the word "poor" been used, there would be a tendency for him to ignore that field in which his experience is slight.

The Experience Chart

The first form used in the system is the employee's experience chart. It contains spaces for both personal and experience ratings. In applying for employment at Pioneer the applicant partially fills out one of the forms, checking the experience blanks.

After an employee has worked with Pioneer for a month, his supervisor and the executive staff check the personal quality ratings and review the employee's evaluation of his experience.

For our use, the experience ratings are divided into administrative, master mechanic, drawing board, and shop. The number of specific fields within these general areas is limited only by the capacity of the tabulating equipment and the use of a single punch card.

After the employee's experience chart has been completed, the information is recorded on a card by key punching and filed in serial number sequence. These cards do not bear the employee's name or identify him in any way except by number and talents.

How Selections Are Made

When an assignment arises requiring a certain type of individual with specific technical qualifications, the rating cards are sorted mechanically and all except those marked "exceptional" or "above average" on the desired experience points are eliminated.

We then have before us the cards of all the men qualified for the job on the basis of skill and work experience. In analyzing the job, we have listed the personal traits which are of primary importance. Therefore, a second sort is made to find the men among the technically acceptable personnel having high ratings on those points.

Information contained on the cards remaining is then listed on a rating report sheet. The usual listing sequence places the individual with the highest personal and experience qualifications at the top of the list. Selection from that point is based purely on mathematical sequence. After the individual is chosen by serial number, his identity is checked and his file reviewed for a final judgment.

A job to be filled might be that of a supervisor on a project involving product engineering on a mechanical device. In this case the personal and record characteristics would be of primary importance and would be combined with general work experience and exceptional ratings in product design, product and methods analysis. We would first sort the cards for men of dependability, ability to teach, leadership, vision, and originality, and then check these cards for the best ratings in the desired experience areas.

Aluminum instead of copper? Keep in mind certain differences in the physical characteristics of the two metals . . .

Characteristic	E.C. Aluminum Hard Drawn	Tinned Copper Annealed
Tensile strength, p.s.i.	25,000-29,000	30,000-35,000
Specific gravity (water=1)	2.71	8.89
Melting point, deg. F.	1220	1981
Elongation, per cent	2.0	35.0
Resistivity at 68 deg. F. ohms per cir. mil-ft.	17.02	10.785
Relative conductivity at 68 deg. F.	61.0	96.16
Relative current-carrying capacity, per cent (National Electrical Code)	84.0	100.0

TABLE I. Characteristics of Aluminum and Copper Conductors up to Size No. 10 AWG.

WHEN YOU CONSIDER USING

G. A. VAN BRUNT • ASSOCIATE EDITOR, FACTORY

WHEN USING ALUMINUM CONDUCTORS in place of copper it is necessary to keep in mind certain differences in the physical characteristics of these metals. Use of aluminum buses, along with wires and cables in the larger sizes, goes back more than 50 years. Recently the shortages resulting from an unprecedented demand for copper have created interest in the so-called building wire sizes of aluminum conductors. The National Electrical Code permits the use of this metal in building wire. Several companies produce aluminum wires and cables in standard sizes from No. 12 AWG. to 2,000,000 cir. mil.

The characteristics of aluminum (Table I) that are of particular interest here are:

Electrical conductivity. The conductivity of electrical grade (E.C.) hard-drawn aluminum wire is not less than 61.0 per cent of International Annealed Copper Standard.

Direct-current resistance of aluminum at 25 deg. C. (77 deg. F.) is 1.64 times that of bare annealed copper, or about 1.59 times that of tinned or alloy-coated copper.

The a.c. resistance of aluminum conductors may be found by multiplying the d.c. resistance value by the a.c./d.c. resistance ratio given in a table that may be obtained from manufacturers. Up to and including No. 2/0 size this ratio is 1.000 for aluminum conductors in air or in non-metallic or metallic conduit or sheath. Above this size the ratio increases from 1.001 for No. 4/0 conductor in air or non-metallic conduit to 1.089 for 2,000,000 cir. mil cable. When the conductor is in metallic conduit or sheath the a.c./d.c. ratio rises from 1.003 for No. 3/0 to 1.54 for 2,000,000 cir. mil cable.

Voltage drop. Carrying capacity and voltage drop are the principal factors in determining the size of wire for a given service. Tables are available showing the voltage drop of both copper and aluminum cables under a variety of condi-

Size AWG. or MCM.	Single Conductor in Free Air — Type of Insulation: R Copper	R Aluminum	RH Copper	RH Aluminum	Not More Than Three Conductors in Conduit — Type of Insulation: R Copper	R Aluminum	RH Copper	RH Aluminum
14	20	..	20	..	15	..	15	..
12	25	21	25	21	20	17	20	17
10	40	34	40	34	30	25	30	25
8	55	46	65	55	40	34	45	38
6	80	67	95	80	55	46	65	55
4	105	88	125	105	70	59	85	71
3	120	101	145	122	80	67	100	84
2	140	118	170	143	95	80	115	97
1	165	139	195	164	110	92	130	109
0	195	164	230	193	125	105	150	126
00	225	189	265	223	145	122	175	147
000	260	218	310	260	165	139	200	168
0000	300	252	360	302	195	164	230	193
250	340	285	405	340	215	181	255	214
300	375	315	445	374	240	202	285	239
350	420	353	505	424	260	218	310	260
400	455	382	545	458	280	235	335	281
500	515	432	620	521	320	269	380	319
600	575	483	690	580	355	298	420	353
700	630	529	755	634	385	323	460	386
750	655	550	785	659	400	336	475	399
800	680	571	815	685	410	344	490	412
900	730	613	870	731	435	365	520	437
1000	780	655	935	785	455	382	545	458
1250	890	748	1065	895	495	416	590	496
1500	980	823	1175	986	520	437	625	525
1750	1070	899	1280	1075	545	458	650	546
2000	1155	970	1385	1162	560	470	665	559

TABLE II. Allowable Current Carrying Capacity in Amperes of Copper and Aluminum Conductors*. (Based on room temperature of 30 deg. C.—86 deg. F.)

*From Tables 1 and 2, National Electrical Code, 1947

ALUMINUM WIRE AND CABLE

tions. Practically, an aluminum conductor or cable two AWG. sizes larger than a given copper conductor will give the same voltage drop under the same conditions. If voltage drop is not a critical matter, it is often possible to use an aluminum conductor of the same size as copper.

This is true also with very short runs and very large cables carrying alternating current. Here the inductive reactance tends to equalize the effective conductivity of the two metals. Inductive reactance is a major part of the impedance, and is the same for both metals.

Heat conductivity and capacity. Although aluminum is a comparatively good conductor of heat, it is inferior to copper in this respect. Therefore heat will not be dissipated along a piece of aluminum wire so readily as along a copper conductor of the same size.

The heat storage capacity of aluminum is approximately 30 per cent less than that of copper. However, the heat storage capacity of aluminum and copper conductors having approximately the same impedance or voltage drop will be practically identical. Therefore, in the event of a short circuit the temperature rise of aluminum and copper conductors will be the same.

Aluminum expands more than copper, when heated. This characteristic becomes of interest in duct or conduit work. Under a 40 deg. C. rise a 50-ft. piece of aluminum conductor will increase about 0.55 inch in length, whereas a copper conductor will become about 0.40 inch longer.

Carrying capacity. One of the most notable differences between aluminum and copper conductors lies in the current-carrying capacity of the two metals (see Table II). The allowable loading of aluminum conductors is, according to the National Electrical Code, 84 per cent of that for the same size of copper conductor under like conditions.

It was mentioned previously that a given aluminum conductor will have about the same voltage drop and resistance as a copper conductor two AWG. wire sizes smaller. The same relationship applies also to current-carrying capacity. That is, an aluminum conductor two AWG. sizes larger than a given cop-

per conductor will have about the same or slightly greater carrying capacity, assuming the same type of insulation and temperature rise.

If voltage drop is not an important factor, the use of insulation with a higher temperature rating will wipe out the disparity in the current-carrying capacity of aluminum and copper conductors. That is, an aluminum conductor with heat-resistant insulation, Type RH, will have approximately the same carrying capacity as a copper conductor of the same size with Code rubber (R) insulation.

Therefore, it is not always necessary to use conduit of a larger size than would be required for copper conductors. It was noted previously that aluminum conductors have only 84 per cent of the current-carrying capacity of copper conductors of the same size. Use of type RH insulation, however, raises the permissible current-carrying capacity about 19 per cent. Therefore, an aluminum conductor with RH insulation is equivalent to a copper conductor of the same size with type R insulation, and may be used in place of it, if voltage drop is not a factor. The over-all diameters of the two conductors will be approximately the same.

Smaller aluminum conductors, Nos. 6 to 12 AWG. inclusive, are available with type RU (latex) insulation, which makes the diameter of the insulated wire smaller than the equivalent copper conductor with type R insulation. Therefore the same number of, say, No. 12 type RU aluminum wires can be put in a conduit as No. 14 copper wires with type R insulation.

Weight. Aluminum is much lighter than copper. One pound of this metal will produce three times as many feet of a given size of wire as copper. Insulated aluminum conductors weigh about half as much as a corresponding copper conductor.

Tensile strength. In respect to tensile strength aluminum is definitely weaker than copper. Aluminum conductors are not annealed after drawing, whereas copper conductors are. Under these conditions aluminum conductors have a tensile strength of approximately 25,000-29,000 p.s.i., depending on the size, whereas tensile strength of tinned copper conductors ranges from 30,000 to 35,000 p.s.i.

This disparity in tensile strength, however, may have little practical significance because aluminum conductors chosen to carry the same electrical load and operate at the same temperature rise as copper conductors will be larger by, say, two AWG. wire sizes and thus have strength roughly comparable to that of the copper conductors.

Because of the light weight of aluminum conductors the tensile strength in any event is sufficient to sustain safely about twice the length of vertical riser that is permissible with copper conductors.

Flexibility. Insulated aluminum conductors have approximately the same degree of flexibility as annealed and insulated copper conductors, even two AWG. sizes smaller. Tests indicate that insulated aluminum conductors will withstand repeated flexing at one spot as well as copper conductors of the same size. Of course, the type of insulation, the method of applying it, and various other factors will determine the flexibility of any insulated wires or cables.

Fatigue strength. Hard-drawn aluminum has a lower fatigue strength, approximately 7000 p.s.i., than copper, 10,000 p.s.i. On this basis it might appear that aluminum conductors would tend to fail under the reversal of stresses brought about by the expansion and contraction of insulated cables, or because of vibration to which motor or other leads may be subjected. Stresses caused by expansion and contraction take into account the modulus of elasticity and the coefficient of expansion. Aluminum has a lower modulus of elasticity than copper—about 10,000,000 p.s.i., compared to 17,000,000 p.s.i. for copper—which tends to compensate for the higher coefficient of expansion. As a result, the stresses in aluminum conductors are lower than in the same sizes of copper conductor. In aluminum and copper conductors of the same current-carrying capacity the stresses will be about equal.

Under vibration the stresses in an aluminum conductor will in some instances be the same as in a copper conductor. In other cases they will be only one-half or three-fourths as much.

Splices and connections. Aluminum conductors can be joined in any of the ways commonly used with copper.

Welding of conductors has been used successfully for a long time. An oxyacetylene torch or an inert-gas-shielded arc may be used. The latter method is considered superior in some respects, but has the disadvantage that the equipment required may not always be available where needed.

Soldering is likely to be a more convenient way of joining aluminum conductors on the job. This process can be used when making aluminum-to-aluminum or aluminum-to-copper connections, and does not involve any special techniques or problems. A torch, soldering iron, or dip ladle may be used. About the only change from standard practice is the use of fluxes and solders that are especially adapted for use with aluminum.

Application of lugs to aluminum conductors presents no difficulties, provided the special fluxes and solders mentioned before are used. The strands of the conductor and the inside of the lug are tinned. Then the lug is filled with solder and the conductor is inserted in it and held until the solder solidifies.

Compression fittings for aluminum conductors usually give the best results when they are made of E.C. grade aluminum. The reason is that both fitting and conductor will then have the same coefficient of expansion and rate of recovery after compression.

Bolted connections also may be used successfully. For best results the fitting should give a high contact pressure over a large area. Also, such fittings ought to be protected from corrosion by a good coating of tin, cadmium, or zinc.

Corrosion resistance. Aluminum has good resistance to corrosive atmospheres such as may be found in plating rooms and other places around industrial plants, or along the sea coast. It is attacked by strong alkalis and some acids; hence care must be exercised when using it around such solutions. On the whole, however, aluminum conductors can be expected to last as long as copper, in any places where types RU or RH insulation are approved for use.

It is to be noted, nevertheless, that aluminum is anodic to copper, which means that under severe conditions the aluminum may be corroded if it is in contact with copper. Therefore, it is advisable to apply a good weatherproof paint or rubber tape to exposed aluminum-copper joints.

LOOKING AHEAD IN LABOR

Last-minute round-up as we go to press

Between the lines, Dewey's Pittsburgh speech gave union leaders this advice: "We have to live with the Taft-Hartley law for four years. Let's change it where it needs changing, and make it work."

Dewey wanted the labor bosses to know that, as President, he would welcome their counsel—within his 12-point program. He extended the olive branch.

On the whole, Dewey likes the Taft-Hartley law. He would make only moderate changes. One possibility: Patch up the hiring-hall ban and drop union-shop elections.

A tip-off: NLRB has given up trying to hold union-shop polls in the construction industry, and Senator Ives, a Dewey man, is dusting off his bill to allow a union shop without an election—if unions file non-Communist affidavits.

Dewey very specifically promised a higher minimum wage: "The present minimum wage set by law is far too low and it will be raised."

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The CIO convention in Portland, this month, faces a crisis comparable to that in the AFL in 1936, when it expelled 10 unions, thus starting the CIO.

Philip Murray's problem: *What to do about 11 left-wing unions following the Communist Party line?* Serious splits have developed in New York, Canada, World Federation of Trade Unions. We don't look for a CIO break-up right now. Neither side can stand it. Yet both sides act as if the showdown were here.

What's John L. Lewis going to do? That's become a stock question in both management and labor circles. The United Mine Workers' convention gave some idea.

Key demands on coal operators before the contract expires June 30 will include a portal-to-portal, 35-hour week at more pay than is now received for 40 hours. Also an increase in the 20-cents-a-ton welfare royalty to 30 or 40 cents. *These were expected.*

Unexpected: UMW's plan for "assured regular employment." It would include creating a national stabilization agency to supervise production. The Miners also want Lewis's birthday anniversary—February 12—to be a paid holiday. Step aside, Abe Lincoln.

By next June, the three years of 5-10-20-cent tonnage royalties will have poured $191,000,000 into the union's welfare fund. This is $61,000,000 more than UMW members have paid into the union since 1890.

With pensions and other welfare benefits going only to UMW members, carrying a UMW card is a valuable financial asset. But membership will cost more, too. Dues were raised from $2 to $4, initiation fees from $10 to $50.

In turn, Lewis's $25,000 salary was doubled. Vice-Pres. Thomas J. Kennedy and Sec.-Treas. John Owens got increases from $18,000 to $40,000. And the 24 international board members will get $1000 a month, instead of $500.

This Supreme Court term will be a big one from labor's standpoint. State laws under review include: Closed-shop bans in Nebraska, Arizona, and North Carolina; a picketing law in Missouri; California's "hot cargo" Act; and the Wisconsin Employment Peace Act.

In the federal field, the Supreme Court is looking at NLRB's order that four North Carolina cotton mill owners unfairly denied use of a company-owned community hall—the only one in town—for a CIO organizing rally.

In the Crompton-Highland case, the Court will say whether an employer may unilaterally grant wage increases to meet competition after collective bargaining has reached an impasse. NLRB says he can't.

Wage-Hour officials hope the Court will upset a circuit court decision which they feel questions the validity of Wage-Hour injunctions against employers. The lower court refused to hold a paper company in civil contempt for alleged violation of a 1943 injunction because the violations were not "willful."

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More labor cases are on the way to the Supreme Court. One is the Inland Steel decision that employers may not refuse to bargain on employee pensions. Another is last May's railroad strike injunction.

Walter Reuther's UAW-CIO asks the Court to void the 1947 law curbing portal-to-portal pay. And the AFL Teamsters want it to upset Tennessee's closed-shop ban.

Taft-Hartley law tests winding their way up:

1. *Ban on spending union funds for political advertisements.* AFL Painters were convicted in Hartford.

2 *Non-Communist affidavits,* an issue in Inland Steel and in a case involving Woolworth. Three circuit courts have upheld the oaths in split decisions.

3. *Contempt conviction* and $1,420,000 fines against John L. Lewis and UMW for ignoring the 80-day coal strike injunction last May.

4. *Closed-shop ban.* It will come up in a test of NLRB's order that the CIO Maritime Union's hiring hall demand against four tanker firms is illegal.

LOOKING AHEAD IN BUSINESS

Last-minute round-up as we go to press

What will 1949 be like? That's a key question for business today when equipment purchases, sales and equipment programs, and budgets must be shaped up.

So, as a preview of its comprehensive outlook for 1949, FACTORY here takes a look at construction, which is a major key to the course of all business.

Construction as a whole—housing, industrial and commercial building, utility construction, schools, roads, hospitals, and hotels, both public and private work—will smash records in total dollar volume this year. Running more than 30 per cent ahead of 1947, it seems sure to add up to $18.5 billion for 1948. Because of increases in costs and prices, however, that will be an increase of only 10 to 20 per cent in the industry's physical volume this year over last.

Housing will probably hold its own in 1949. This year the industry will complete close to a million permanent homes. That's about $8 billion worth and is an all-time record, both in dollar volume and in units.

Looking at the post-war record, one striking fact emerges: *Enough new homes have been thrown up to wipe out the most pressing part of the housing shortage.*

Chief measure of the housing shortage is the number of new families formed since 1941. The war and post-war years (through 1948) added about 4¾ million new families to the U.S. population. And in that period there was a net movement of several hundred thousand families from farms to urban areas. That means that about 5 million families had to get in out of the rain.

But in those same years builders will have started some 4 million new permanent non-farm homes, thrown up about 350,000 temporary units, and converted a half-million apartments and homes out of existing buildings.

That means that our stock of homes now is relatively about as good as it was before the war.

But that doesn't mean that the boom in housing is automatically over. **For one thing, we had a housing shortage even in 1941 because the number of new homes built in depression years fell far behind the country's needs.**

For another, there are still perhaps 2 million families "doubled" up with others—and many of them want new homes. Then, too, our housing standards are going up. People are no longer content with the tenement apartments and Victorian homes they put up with before the war. New families will be formed in the years to come, too, and they'll require about a half-million homes a year.

So 1949—and 1950—may well see home-building go on at close to a million-a-year rate.

Private construction other than housing—offices, warehouses, factories, churches, schools, farm work, and public utility construction—is running to about $6.5 billion this year.

Next year industrial construction, which has been declining for some months, is expected to slip off a little more. Faced with the pressure for more production, manufacturers are putting a major part of the money available for new facilities into equipment, rather than plants.

But the utilities—which are doing some $2.5 billion worth of construction this year to meet the demands on them for greater service—are expected to increase their budgets next year. And office, warehouse, and store construction is sure to expand.

That means that, all in all, private construction is likely to hold its own next year, may even gain slightly. Running at about a total of $14.5 billion this year, it will probably do as well next.

Meanwhile, public construction—roads, sewer and water systems, hospitals and schools, and conservation and development programs—is expected to rise sharply in the next 12 months.

This year it will run to about $4 billion in dollar volume. Next year it may well reach $5 billion.

That—added to the prospect for private work—gives an estimated volume for all construction next year of about $19 billion.

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There's a danger signal up for construction, however. Indexes of construction costs show a fast-rising curve—one that is climbing faster than incomes, residential rents, or business profits. That means construction costs have been getting out of line with ability to pay for construction—and are getting further out.

These fast-climbing costs may produce a slow-up—particularly in home-building—early in 1949.

Even with this kind of hitch, the industry seems certain to do even better next year than it is doing now.

But, before too long, contractors will have to make a dramatic cut in their costs to keep on going ahead at capacity operation. Basically, however, there's a huge accumulation of needs for public works. You need drive only half an hour almost anywhere in the country to see how highways must be improved, for example. Such needs may total $100 billion.

So, the prospect of high-level operation in construction next year—and after—is a reassuring note to business.

MANPOWER MEMO

DEPARTMENT 23 SUPERVISOR J. Hallstein - Supervisor

NAME	WIFE'S NAME	NAMES AND AGES OF CHILDREN	BIRTHDAY	HOBBIES	OUTSIDE ACTIVITIES	HOME CONDITIONS
John Clifford (Jack)	Helen	Jack Jr. 7 Jane 9	Nov 10, 1912	Fishing Hunting	Red Cross	Excellent
James Sperry (Jim)	Mildred	Jean 10	Jan 9, 1910	Photography	Runs photo developing shop	Wife invalid
Earl Roberts	—	—	June 15, 1927	Baseball	Amature Baseball	Rooms out
Richard Williams (Dick)	Josephine	Arthur 15 Mary 18 Betty 22	April 3, 1906	Stamps Antiques	Red Cross	Excellent
Edward Watson (Ed)	Margaret	James 2	August 20, 1916	Football	Coaches local High School team	Good
Robert Lovejoy (Bob)	Joan	Bob, Jr 6 Cathrine 4	Dec. 22 1921	Aviation	Heads local Aviation Club	Girl partly crippled

GLANCE AT SIMPLE RECORD REMINDS FOREMAN TO WISH JACK CLIFFORD MANY HAPPY RETURNS—OR TO ASK JIM SPERRY ABOUT HIS WIFE

"MANPOWER MEMO" GIVES FOREMAN PERSONAL FACTS ABOUT WORKERS

Workers are people. The more the foreman knows about them, the better he does his job

KNOWING SOMETHING about the personal problems and achievements of their men helps them do a far better job of running their departments, supervisors at Owens-Corning Fiberglas Corporation have found.

To keep them in touch with the facts about their workers, supervisors use a "manpower memo." As shown above, it consists of general bits of personal information. About every six months the supervisor reviews his file, makes any changes necessary, refreshes his memory.

The memo didn't just happen. It was suggested and developed during a supervisors' conference. At the time, they sought some method of easing the daily contact with their men. A dozen or more personal information categories were listed by the supervisors. Six were selected as being most important.

Then, on a blackboard, a few of the supervisors tried to supply data on men under them. Their lack of information amazed them. They realized how little they did know about the workers they supervised 8 hours a day, 5 days a week.

The results attained through use of this form have been gratifying. Supervisors are closer to their men and take a real interest in their daily lives. And the workmen respond much better to supervisors who display an interest in them.

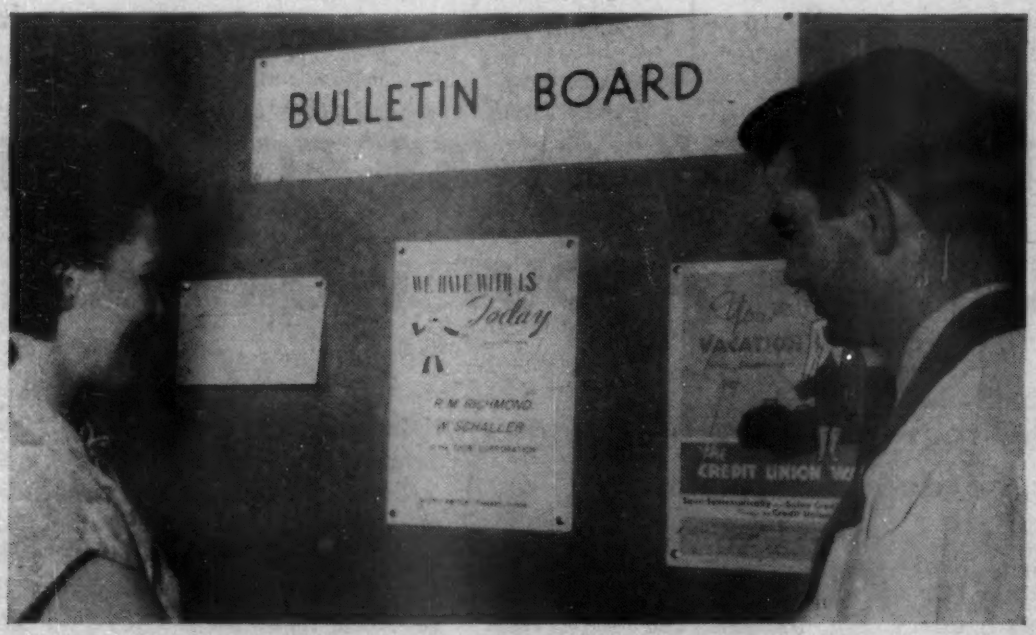
OPERATING SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary operating accomplishments. Accepted articles will be paid for

A "RAILROAD CROSSING" GATE at all dangerous track or roadway crossings makes workers at Post Cereal Division, General Foods Corporation, Battle Creek, Mich., "stop, look, and listen." Workers must lift the gates before they can cross, reminding them of danger. Gates are painted bright red, and not one crossing accident has occurred since their installation

Dispersed Parking Minimizes Fire Danger

The fleet of industrial trucks used by Federated Metals Division, American Smelting & Refining Company, Newark, is dispersed for night parking. These trucks, gasoline operated, represent an investment of more than $60,000. Because of the heavy loads of metals handled, and tight supply of new trucks and parts, Federated cannot risk danger of fire raging through a fleet of trucks parked altogether in orderly fashion. So trucks are placed in places relatively free of fire risk, yet reasonably close to using departments.



POSTERS on bulletin boards tell employees who is visiting at Micro Switch Division, First Industrial Corporation, Freeport, Ill. If the visits are known in advance, posters are made up and attached to the bulletin board before their arrival. However, if they just happen to drop in, posters are made up in a hurry and placed on the bulletin boards. Posters are not made up for everyone who drops in to the reception lobby, but they are for everyone who makes a plant tour

Plot Plans Kept Handy in Wall Case

WALTER F. BREEN, Maintenance Superintendent, Hamilton Watch Company, Lancaster, Pa.

Plot plans are ready for instant reference in the office of Hamilton Watch Company's maintenance superintendent.

An open shallow case is mounted on the wall close by the desk which contains 17 plans of plant layout and services on shade rollers. The plans are blueprinted on cloth from tracings in the file. Each shade bears on the outside pull strip a chromium plate with engraved title, to identify the plan. If any question arises that requires reference

to any plan, the shade is pulled out without fuss or feathers.

These are the titles of the plans which it was felt necessary to keep in the handy wall case: (1) Plot plan, main plant; (2) domestic water feederlines; (3) sewers, sanitary and storm; (4) isometric plant layout; (5) building dimensions; (6) fence data and floodlighting; (7) roof slopes and water leaders; (8) power and light, basements and first-floor level; (9) architect's plot plan, main plant; (10) heating and ventilating, building No. 8; (11) parking lots; (12) power and light, plot plan; (13) sprinkler system, main plant; (14), (15), and (16) power and light, second, third, and fourth floors and dial levels; and (17) Hamilton Park recreational development. Other plans are being added for compressed air, gas, and steam lines.

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WELDER'S HELPERS at Servel, Inc., Evansville, Ind., did not care much about wearing goggles—a situation that resulted in several close to severe accidents from splash burns. Now they wear helmets, striped to differentiate between the welder and his helper. The lens of this striped safety helmet is made from a regular goggle and is more transparent than that in the welder's helmet. The greater visibility allows the helper to move about more freely, but with greater safety

Less Time Needed To Clean Fixtures

Catwalks between rows of lighting fixtures, plus a specially designed rack, make the cleaning of fluorescent lighting units a far simpler job at New Departure Division, General Motors Corporation, Sandusky, Ohio.

Of the 4000 units in this plant, about 2500 are located in high-bay areas. Maintenance men work in pairs on the catwalks, using the rack which holds the fixtures safely in a convenient position while reflectors are cleaned and bulbs replaced.

In the low-bay areas, where catwalks are impracticable, it takes 40 man-minutes per unit to clean a fixture. In the high-bay areas they are cleaned at the rate of 20 man-minutes per unit.

Bench Bins Save Time and Paperwork

EARL B. HAMILTON, Plant Engineer, Buckeye Tools Corporation, Dayton

A drastic reduction in inventory paperwork has resulted from the installation of two rotary bins on each assembly bench at Buckeye.

Inexpensive parts, such as nuts, washers, gaskets, bolts, pins, springs, are kept in these bins. They are checked out of storage a hundred or a thousand at a time, depending on their size and value. Since such parts represent 40 per cent in quantity of the completed tool, this quantity method of distribution saves much time for the inventory control clerk and the stockcrib attendant.

Larger parts required for assemblies are placed in portable racks which are pushed alongside the assembler's bench. Finished assemblies go back on the racks, which then go to the shipping point.

CONTINUED ON NEXT PAGE

Quoit House Provides Year-Round Relaxation

WILLIAM D. BRYSON, Plant Superintendent, Walter W. Moyer Company, Ephrata, Pa.

No matter what the weather, employees of Moyer now can relax at their favorite pastime of quoits in a sheltered quoit house recently built for them.

The quoit house is situated in a grove of trees adjacent to the plant, where it can be enjoyed during lunch hours or after work. It consists of a single-story wood-frame fully enclosed structure, 24x36 feet in size, big enough to accommodate three games. In the warmer weather the glass windows all around the four sides can be swung up on hinges. Permanent screens are fitted outside. The lower solid walls are insulated with rock wool for cold weather conditions. The building is heated by an automatically controlled oil-fired space heater. Benches line the walls.

Spotlights in the roof ceiling are focused on each pin box, in addition to general lighting around the walls. Standard-sized pin boxes contain a hard moist clay which can be easily pounded level after each game. The rest of the floor is made of a special asphaltic concrete which can be patched should poor throws make a dent in it.

Cost of the project was less than $2000. Long-range returns will be considerably more, in management's opinion, in a happier and healthier corps of employees.

Ramp to Floor Scales Eliminates Lifting

A handy wooden ramp, leading to the floor scales, eliminates lifting in the plating department at Snap-On Tools Corporation, Kenosha, Wis. Before, it was necessary for the worker to lift the totepan on to the scales. Over an 8-hour day this procedure became fatiguing.

Now, he merely rolls the totepan up the ramp with a special wheeled holder. He eases the load of material down onto the scale and makes his count by weighing. It is now easy to run as much as 130 pounds of newly finished sockets up to the counting scales in one load.

Stars on Time Cards Reward Greater Output

NAT GOODMAN, Vice-President, Jersey Shore Manufacturing Corporation, Jersey Shore, Pa.

Production in our shirt-sewing factory was in a slump. Workers were intelligent and cooperative, but were slow in increasing their skill. Obviously something had to be done.

Therefore we introduced the "Legend of the Stars."

Our introductory technique was based on human curiosity, and our vehicle was the biweekly time card. Without any advance notice, two operators who had shown rather good production on the previous day found green stars on their cards as they rang out at noon. Their curiosity was appeased only by "It's not anything bad."

The next day other operators found similar stars on their cards, and the time had come to announce their significance, to explain that they were placed on time cards as a recognition of meritorious accomplishment.

This was a good system; it rewarded those who were showing improvement. But it failed to take care of those who were already doing an excellent job—those whose production had already been stabilized at a high level. These girls were the real "stars." When they reported to work one Monday morning, they found large silver stars gleaming against the black finish of their sewing machines.

So that they will know how they stand, the "batting average" of each operator is posted in the numerical order of her piecework earnings; and a list, changed every six weeks, carries the maximum production for each operation, the operator's name, date of achievement.

The results? Over-all factory production has increased 48 per cent. There has been a real increase in piecework earnings. And the enthusiasm of the workers for the program has been reflected in their eagerness to move higher in the standings, get more stars, or achieve the mark of distinction—silver stars on their machines.

BARRETT-CRAVENS
POWER-OX LIFT TRUCK

BARRETT-CRAVENS
POWER-OX LIFT TRUCK

Battery Electric Trucks and EXIDE-IRONCLAD® BATTERIES

Help cut costs, save time, boost production

In plants where materials are handled the modern way . . . by battery electric trucks . . . every department benefits. Materials move more smoothly and in greater volume from processing, through warehousing to shipping. Savings up to 50% are not uncommon for they are made all along the line . . . savings in time, power, maintenance, operating costs. And when Exide-Ironclad Batteries supply the motive power, you can count on full shift availability, day after day, year after year.

Start battery electric trucks working and saving for you. Equip them with safe, dependable Exide-Ironclad Batteries. They have ALL FOUR of the vital characteristics of a storage battery—high power ability, high electrical efficiency, ruggedness, long life.

Write for further particulars and FREE copy of Exide-Ironclad Topics, which covers latest developments in materials handling and shows actual case histories.

1888...Dependable Batteries for 60 Years...1948

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • *Exide Batteries of Canada, Limited, Toronto*

management data 36 sheet

QUALITY CONTROL FUNDAMENTALS

1. Purpose of Quality Control

a. Quality control is a tool of management used to maintain and improve the quality of products to meet competitive standards and reduce the cost of waste.

2. Fields of Application

a. In theory, quality control is essential in all industrial enterprises.

b. In practice, its value increases with the ratio of the cost of waste to the total cost of the product.

3. Principles of Quality Control

a. Establish definite standards of quality, and define clearly the responsibility for the maintenance and control of quality.

b. Evaluate the cost of deviations from quality standards, in order to budget the cost of an effective quality control program.

c. Determine when 100 per cent inspection is necessary, and when inspection by sampling is sufficient.

d. Establish physical inspection methods on the basis of motion study principles.

e. With increased proficiency in quality control, utilize statistical methods of quality control.

f. At all times, the control of quality should be subject to review for maximum effectiveness at minimum cost.

4. Quality Standards

a. Quality standards are generally established on the basis of competition, ultimate use of the product, or selling price of the product.

b. In all cases, the specific quality standards should be defined by the product engineering department, or the comparable department which is responsible for design of the product.

5. Maintenance of Quality

a. After quality standards have been established, it is the responsibility of the manufacturing supervisory staff to maintain them.

b. From group leader to plant manager, each level of supervision should be familiar with the standards, be in agreement with them, and should exercise due authority to insure that all products are manufactured according to standards.

c. It is the responsibility of the inspection department to check the effectiveness of manufacturing supervision in adhering to the standards.

d. It is not the purpose of the inspection department to relieve manufacturing supervision of the basic responsibility for quality.

e. In a sound organization, the quality control engineer, responsible for the inspection department, reports to the chief engineer, to avoid possible weakening of quality standards by manufacturing supervision.

6. Evaluation of Quality

a. In quality control, economics should guide the planning of the program.

b. Before determining specific courses of action, it is desirable that the actual cost of deviations from quality standards be carefully evaluated.

c. Deviations from quality standards generally fall within the following groups: (1) *Raw material waste,* including the cost of raw material in excess of minimum waste resulting from economical manufacture of the product; (2) *scrap,* including the cost of raw material, labor, and overhead resulting from products rejected at any time after the first operation; (3) *rework,* including the cost of excess labor required to salvage rejected products; (4) *credits allowed customers* because of product defects determined after the product has been sold.

d. When deviations from quality standards are evaluated, and projected on an annual basis, it is possible to establish a reasonable cost reduction objective, justifying an an-

CONTINUED ON PAGE 138

Prepared by Bruno A. Moski, Jr., Plant Manager, The American Paper Goods Company, Kensington, Conn.

4,200 HOURS' OPERATION—STILL SLUDGE-FREE

Sun Diesel Lubricating Oil Almost Good As New After Outlasting a Competitive Product 5 to 1

A prominent manufacturer uses 6-cylinder, 4-cycle diesels to generate power. Recently, at the suggestion of one of our engineers, a Sun diesel lubricating oil was tried in one of the units.

Results were impressive. Inspected after three months, the engine was found to be in the cleanest condition since installed. In tests run against competitive oils, one manufacturer's product sludged up in 600 hours. Yet the Sun oil was practically as good as new after 3,000 hours, showing but a slight increase in neutralization number. In further tests, the Sun oil ran 4,200 hours in six months' operation without a change; the engine remained clean and sludge-free, and showed no signs of wear.

On the basis of this performance, the plant has extended the use of Sun oil to other diesel units.

Here is just one example of the records being set by Sun "Job Proved" lubricants in all their wide applications. You can rely on Sun products to keep diesels, turbines, steam engines and other power equipment operating smoothly and with minimum maintenance. To get complete information call the nearest Sun Office. For Technical Bulletin "Lubrication of Diesel Engines," write Department F-11.

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"JOB PROVED" IN EVERY INDUSTRY

management data 37 sheet

QUALITY CONTROL FUNDAMENTALS

CONTINUED FROM PAGE 136

nual operating budget for the quality control function.

7. One Hundred Per Cent Inspection

a. The most costly type of inspection is that in which 100 per cent of the product is inspected after every operation.

b. Because of the expense involved, 100 per cent inspection should be avoided wherever possible.

c. Such inspection may be justified in complex electrical and mechanical products at the completion of final assembly, and in comparable examples, or at critical stages in the manufacture of intricate detail parts or assemblies.

d. In general, 100 per cent inspection should be approved only where excessive cost results from failure of the product.

8. Inspection by Sampling

a. Inspection by sampling represents quality control at its maximum effectiveness—controlling quality with minimum cost.

b. First analyze all operations to determine the mininum points where inspection is required.

c. It is then necessary to determine the degree of accuracy required in the final product.

d. In other words, for each point where inspection is required, decide the acceptable percentage of satisfactory parts in each lot to progress to the next operation.

e. On the basis of the acceptable percentage of satisfactory parts in each lot, select a sample that is sufficiently large to include a similar percentage of acceptable parts, according to the law of probability.

f. The sample selected should be truly representative of the entire lot.

g. Inspect the sample 100 per cent, and determine the percentage of satisfactory parts.

h. When the percentage of satisfactory parts in the sample is equal to or greater than the permissible percentage, the entire lot of parts may be passed.

i. When the percentage of satisfactory parts in the sample is less than the permissible percentage (1) the entire lot may be scrapped, which would represent maximum loss; (2) the entire lot may be inspected 100 per cent, scrapping only the defective parts, representing medium loss; (3) the entire lot may be inspected 100 per cent, with rework performed on the defective parts to meet quality standards, representing minimum loss.

j. Whether 100 per cent inspection or inspection by sampling is selected, all physical inspection methods should be established on the basis of motion study principles, for minimum inspection cost.

9. Statistics of Quality Control

a. The technique of inspection by sampling may be further refined by the application of statistical methods.

b. Statistics are used to determine (1) the size of a sample which is necessary to insure the probability of its being representative of the lot; (2) the probable percentage of satisfactory parts in a lot, on the basis of an analysis of the sample; (3) the extent and trend of a process getting out of control with respect to quality standards.

10. Control of Inspection

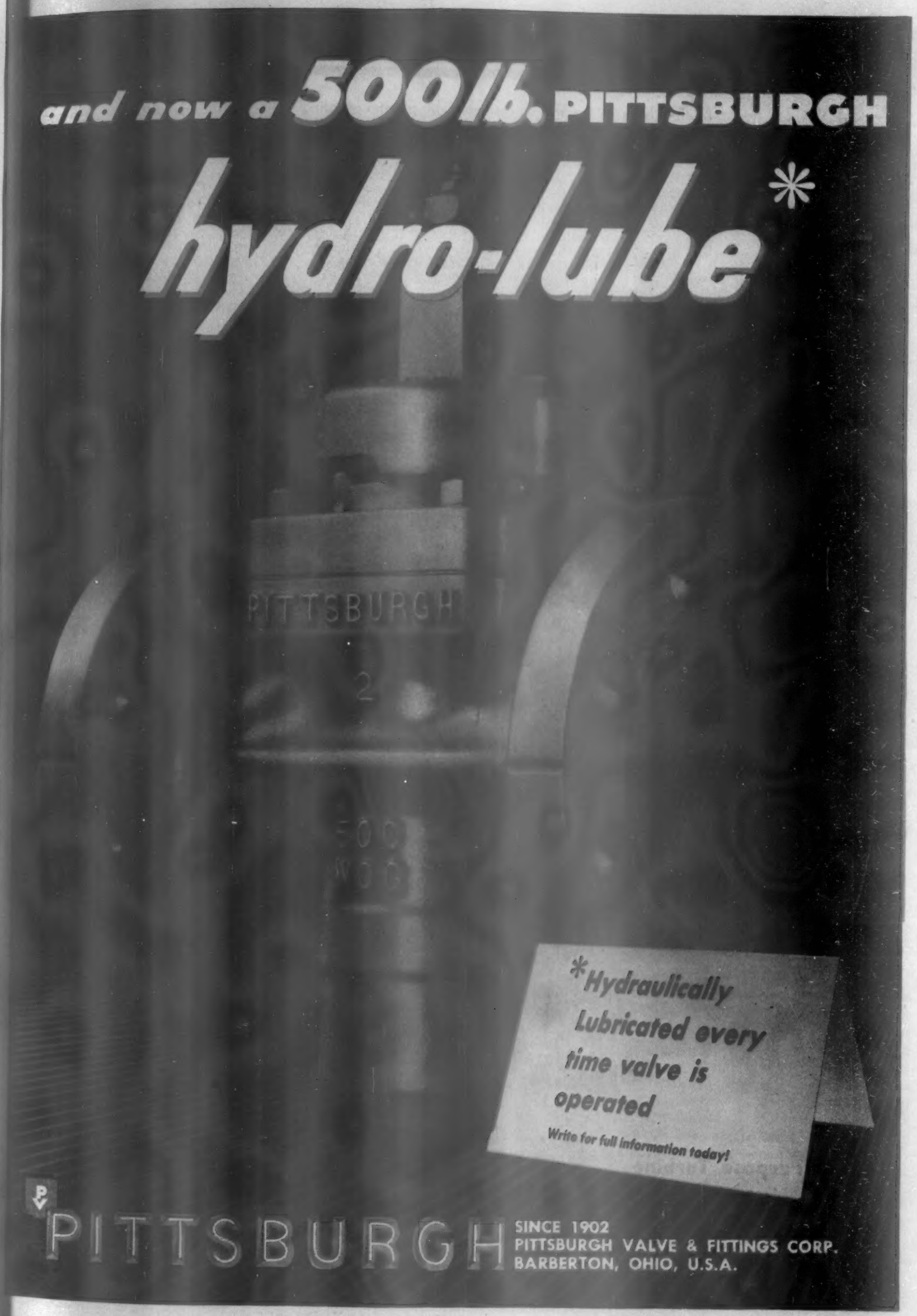
a. Assurance of maximum quality at minimum cost is obtained through the systematic audit of inspection tools, procedures, and results.

b. At regular intervals check physical gages against master gages and standards.

c. Review actual inspection techniques periodically, including the statistical methods, in order to improve the economic control of quality.

d. Apply the principles of inspection by sampling to the work of inspectors, to minimize errors caused by the human factor.

Prepared by Bruno A. Moski, Jr., Plant Manager, The American Paper Goods Company, Kensington, Conn.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WHAT'S NEW IN EQUIPMENT

Briefed here — for the convenience of plant operating men — are descriptions of industrial plant equipment newly placed on the market

Spray Gun

Spray gun, Model B-6900, was designed for use with a limited air supply. By a change of head set-ups, gun can be made to operate on compressors ranging from 1/3 to 1½ horsepower. Maker says it will handle all types of material including synthetic enamels, lacquers, fillers, undercoats, and varnishes. Weight is approximately 1 pound. The Black Mfg. Co., Baltimore.

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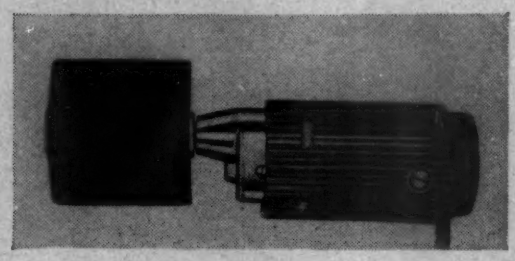

Polisher and Sander

Portable drum polisher and sander, Model 49, can be operated with one hand. Small in size, light in weight, it can be used in any position on wood, metal, plaster, wallboard, and concrete. Corrugated Vinylite covering for the motor housing provides a slip-proof hand grip. No wrenches are required to change the sanding sleeves—a nut on the end of the shaft allows the sleeve to slip off or on. Unit is furnished with a 6-ft. rubber-covered two-wire cord and attachment plug and Gaynor feed-through switch; one sanding sleeve; and one lamb's wool polishing bonnet. Motor is fan-cooled. Over-all length of unit is 9½ inches; weight, 3½ pounds. Portable Electric Tools, Inc., 255-59 West 79th St., Chicago 20.

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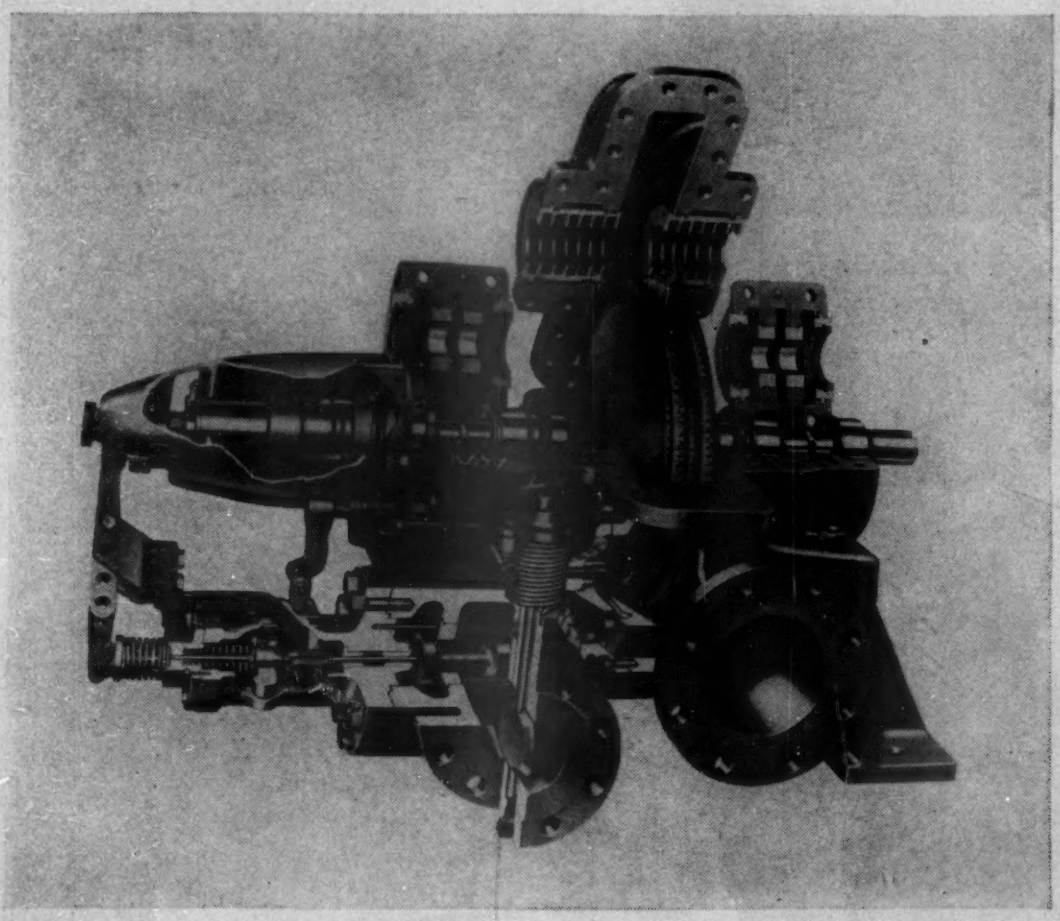

General Purpose Turbine

Pumps, fans, blowers, and other machinery can be driven by all-weather general-purpose turbine, according to its manufacturer. Three wheel sizes, 16, 20, and 25 inches, are said to permit unit to be applied from 5 to 1500 horsepower, with steam up to 600-lb. gage at 750 deg. F., and speeds of from 1000 to 7000 r.p.m. Combination felt and labyrinth bearing seals protect the lubricating system from rain and abrasives. Overspeed trip simultaneously closes governor valve and butterfly valve. Equipped with shaft-type governor. Westinghouse Electric Corp., Box 868, Pittsburgh 30.

Bench-Mounted Heater

Average operating cost of 1 kw. radio-frequency heater, employing two General Electric GL-592 electronic tubes, is about 5 cents an hour at full load, including tube replacement cost, according to the manufacturer. It is said that processing temperature can be reached in 1 to 5 seconds, depending on the size of the workpieces. High-frequency, bench-mounted heater is designed to handle brazing, soldering, annealing, and heat-treating of moderate workpieces of any metal. It may be used for both induction and dielectric work. Sherman Industrial Electronics Co., Belleville, N. J.

•

Flat-Bed Truck

All-steel flat-bed warehouse truck is suited for either mechanized or manual handling. Bed of the truck is 10-gage steel, formed with side flanges. Five supporting steel crossbars under the bed keep it from

Another Example

How Alemite Methods Cut Production Costs

Cuts "Time-Out" for Lubrication up to 64%

Increases Productive Time of Machines by Mechanizing the Handling and Application of Lubricants

Your Lubrication Methods May be More Antiquated Than You Suspect

If your oilers are still lubricating your machines by hand, bearing by bearing, you're losing manhours and cutting productive time of your machines. It's time to check up! The Alemite Representative is a specialist in modern methods of handling and applying lubricants. A five minute conference with him can easily show you new cost-cutting opportunities. Write to Alemite, 1870 Diversey Parkway, Chicago 14, Illinois. Call your Alemite jobber.

If you lubricate your machines with hand guns, here's news for you. By actual time-study, a new Alemite Method of power lubrication is 64% faster from barrel-to-bearing than the best hand grease gun methods. To say it another way—you can save up to 23.9 hours in applying each 100 pounds of grease!

It's the new 25 pound capacity Alemite Portable Electric Powergun. It's fast, it's positive, it develops 5000 lbs. grease pressure. And it helps add more productive time to machines . . . gives you extra hours to use for much needed preventive maintenance.

Just one of many ways that Alemite Methods help industry cut production costs through simplified lubrication procedures. The Alemite Representative can show you case after case where time-study analysis has proved that Alemite Methods reduce maintenance costs. These methods eliminate costly time-consuming handling of oils and greases . . . slash "time-out" for lubrication . . . keep dirt and moisture out of lubricants . . . completely mechanize lubrication from barrel-to-bearing . . . save grease. These benefits all add up to lower production costs. Get the complete facts, today.

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MODERN LUBRICATION METHODS THAT CUT PRODUCTION COSTS

"bellying" or sagging. Four of the crossbars serve as mountings for the wheels. A 4-in. steel channel bar provides mounts for front and rear hitches used in mechanized trains. Rear hitch is surrounded by a steel guard rail to prevent it from damaging material with which it might come in contact. Garrick Industries, Inc., 9018 West Olympic Blvd., Beverly Hills, Calif.

•

Lumber Handling Unit

Self-powered lumber handling unit is adaptable to the De Walt, Wilson, Skilsaw, and other types of radial saws, and can be furnished to fit the major types of table top saws. Known as the Safe-T-Mill, the spur wheel feeds boards automatically through the saw at variable speeds, while the rubberized wheel draws the material through at the same synchronized speed. Other automatic feed operations include bevel rip, plough, rabbet, or bevel rabbet. Motor is rated ¼-hp., 110-220 volts, single-phase, or three-phase 220 volts. Feeding speed can be adjusted from 35 to 120 f.p.m. Power Development Co., Inc., 6719 Denison Ave., Cleveland 2.

•

Flexible Joint

Suitable for use with maximum internal pressure of 1000 p.s.i. and 600 deg. F. maximum temperature, all-metal swivel joints, called Swivlex, are constructed with an internal equalizing chamber said to balance pressures on both sides of the swivel seat. Stainless steel bellows act as seep-proof, self-adjusting springs, keeping the metal-to-metal seat under pre-adjusted pressure to prevent leakage. Automatic internal stop prevents accidental abuse in service, and an invisible lock prevents unauthorized tampering. Manufacturer says joints are easy to turn, eliminating any destructive twist in metal hose. Suitable for use with steam, water, oil, or air in applications on hydraulic platen presses or other equipment calling for swivel or reciprocal movement. Standard sizes are available up to ½ inch I.D. Seamlex Co., Inc., 41-23 24th St., Long Island City, N. Y.

•

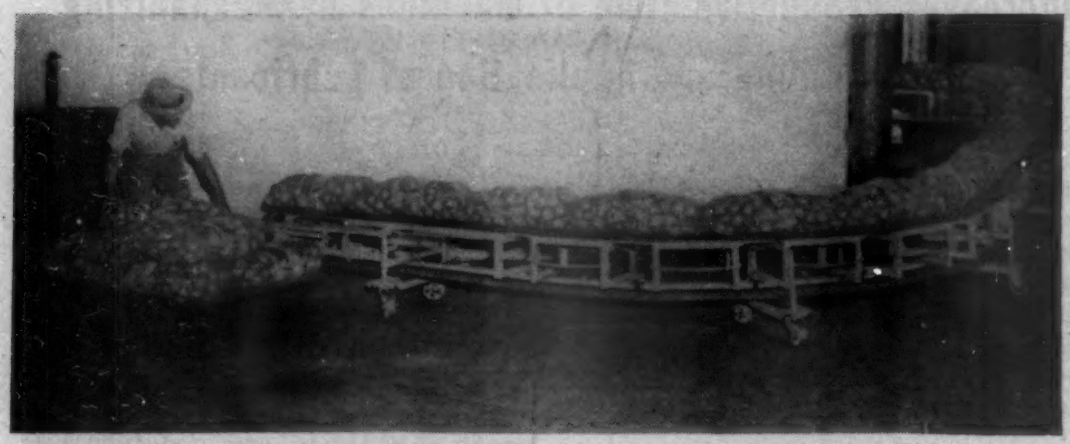
Emergency Lamp

Emergency lamp and signal flare, called Big Beam 400-F, is made with rustproof and weatherproof baked enamel steel container for the two standard dry-cell lantern batteries and connection. A double-throw, single-pole switch gives instant selection of either the steady light or the flashing flare. Light is visible in all directions for over 600 feet. Ordinary life of the batteries is said to give continuous flashing for 28 hours, or a steady light for 20 hours. Two independent bulbs are used. If one burns out, the other continues to operate. A spare bulb can be kept in a dummy socket. Bulbs are coverd with a red Fresnel lens of molded plastic. Clear, amber, and blue lenses also are available. U-C Lite Mfg. Co., 1050 West Hubbard St., Chicago 22.

•

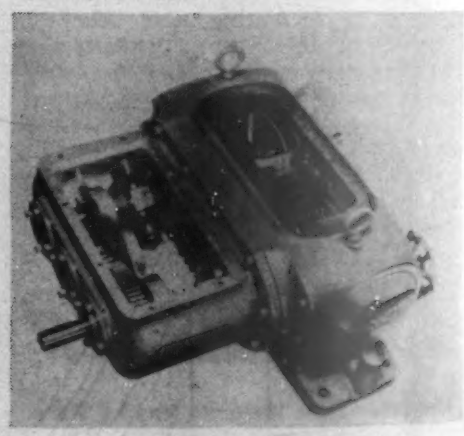
Squirrel-Cage Motors

Line of tube-type, totally enclosed, fan-cooled, squirrel-cage motors is available in models ranging from 150 to 600 horsepower. Internally, the motor is divided into two isolated parts, with each side having its own path of internal air circulation. Manufacturer states that this construction, with simple maintenance, keeps the air passages free. Models can be obtained with Underwriters' labels for 1-D or 2-G locations in ratings of 3600 r.p.m., 250 to 400 horsepower; 1800 r.p.m., 200 to 300 horsepower; and 1200 r.p.m., 150 to 200 horsepower. Allis-Chalmers Mfg. Co., Milwaukee.



Conveyor

Flexible four-way conveyor that will carry packaged materials or equipment through a boxcar door and to the end of the car, is available in 20- to 40-ft. lengths. It operates on a continuous track principle. Maker states that conveyor can be curved into more than 90-deg. turns, and that a 90-deg. turn is possible in a floor space of 6 feet. Unit is flexible horizontally and vertically at the same time, and can be formed into *S* or *L* turns, because each unit rolls on heavy casters. Motion is reversible for loading and unloading operations without moving the conveyor. The 2-hp. electric motor needed to operate the units is furnished. Standard 2-ft. sections can be added to the conveyor to make up any length. H. W. Creager Mfg. Co., Arvada, Colo.



Transmission

Transmission, called Specon MD, is designed to provide variable speed within wide ranges. Unit consists of a mechanical differential attached to a standard Link Belt PIV unit. Four models provide any speed, either forward or reverse, between 0 and 7000 r.p.m. Output torque range is from 20 inch-pounds (minimum speed) to 15,460 inch-pounds (maximum speed). Net output horsepower varies in different mod-

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FIELD ENGINEERS AND SUPPLY DEPOTS IN PRINCIPAL CITIES

els and speeds, from 1 to 20 horsepower. Desired speed is set by a handwheel and indicated on a large dial. A vernier dial can be provided to permit close speed settings. Speed Control Corp., Dept. B6, Wickliffe, Ohio.

•

Soft Hammers

Safety features, which include a formed tubular steel handle and diamond knurled grip, characterize line of soft hammers made with heads of cast brass or copper. Manufactures says that these heads will mushroom but not fracture. They are molded on the end of the handle, which is crimped into a butterfly to eliminate the need for wedges. Available with heads in ½-, 1½-, 2-, 2½-, 3-, 4-, 5-, and 6-lb. sizes. Univertical Machine Co., Box 144, Route 2, 14831 West 11 Mile Rd., Royal Oaks, Mich.

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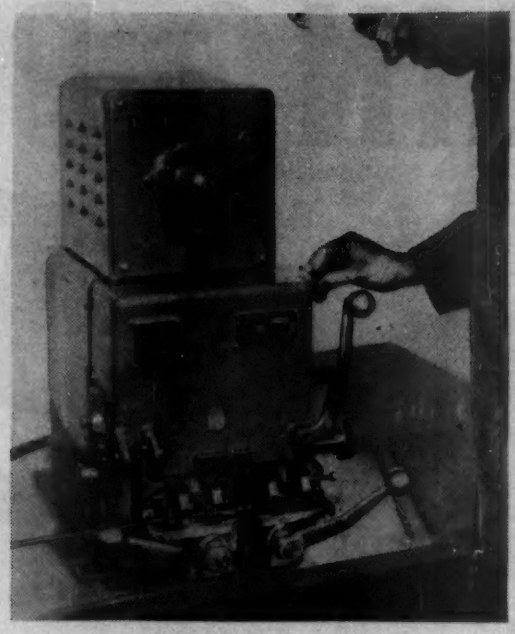
Air Conditioning Unit

Small air conditioning unit, designed to protect crane operators from heat, dust, fumes, and noxious gases, is said to provide summer cooling, winter heating, and continuous ventilation. Suitable for operation in ambient temperatures up to 130 deg. F., unit is claimed to maintain cab temperatures at 80 to 85 degrees in summer and 68 to 72 degrees in winter. A vertical unit, 5 feet 5¾ inches high by 2 feet 2 inches by 2 feet 9 inches, unit can be mounted alongside a crane cab or placed on adjoining catwalks. Only a power line is needed for its installation. The 3-hp. compressor motor is force-ventilated by filtered air. Controlling thermostats are installed within the unit. Supply and return air openings are located on top of the cooler to minimize ductwork. Dravo Corp., Fifth and Liberty Aves., Pittsburgh 22.



Flash Welder

Flash welder, Model DBW-5, will join bandsaw blades up to 2 inches wide. It is equipped with special inserts that will join wire, drill rod, bars, flat stock up to 5/16 inch in diameter. Manufacturer states that unit provides a welding service that includes preparation of the material for welding, annealing, and cleaning up the weld. Weld cycle is motor controlled and automatic. Other features include a positive stop on the movable jaw travel to prevent accidental contact; front aligning controls for making positioning adjustments to the welding jaws; selective annealing heats; alloy welding jaws to prevent accumulation of flash metal; replaceable wear strips for welding jaws; grinding unit for preparing material and grinding off flash; thickness gage for dressing the weld to proper thickness. A lighter-duty model, DBW-1 butt welder, also is available, suitable for welding saw blades up to ⅝ inch wide, for bench or pedestal mounting. The DoAll Co., Des Plaines, Ill.

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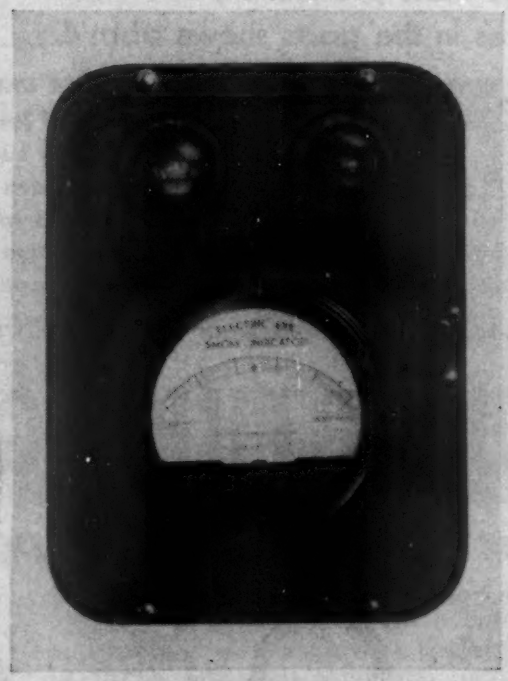

Smoke Control

Electric eye smoke indicators, designed to control overfire air and to prevent smoke in coal burning furnaces, project a light beam across a boiler or furnace flue to a phototube which measures smoke density. When density increases beyond a predetermined amount, a red warning light flashes, and a timing relay circuit is closed. Overfire jets are started, which remain on for the time that the timing relay circuit is set—from 20 seconds to 20 minutes. Upon completion of the time cycle, the jets are automatically turned off. Manual pushbutton operation of jets also is provided. Light source is a 6-volt prefocused bulb operated normally at 5 volts or less, and warning light is adjustable to any degree of smoke density. Smoke indicator will give a visual indication of the flue gas density at all times. Recorder and audible alarm can be provided, as well as modulated control of continuous overfire air. Brooke Engineering Co., Inc., 4517 Wayne Ave., Philadelphia.

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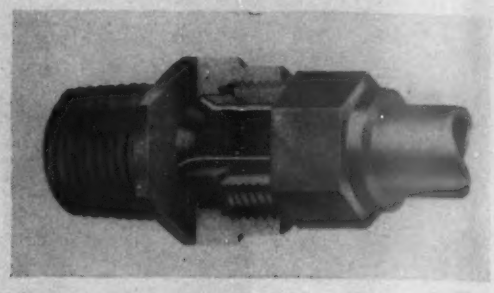

Tube Fitting

Leak-proof, self-flaring tube fitting, called Uniflare, which, maker says, can be taken apart and reconnected without weakening the seal or damaging the flare, has only two parts —body and nut. The thrust collar in the nut shears off, under ordinary wrench force, and clamps onto the tube to form a sealed joint. Fitting has a 37-deg. flare, and inverted-type joint to provide multiple sealing surfaces. Available in a range of sizes and shapes, for use with copper, aluminum, monel, and annealed steel tubing. Scovill Mfg. Co., Waterbury 91, Conn.

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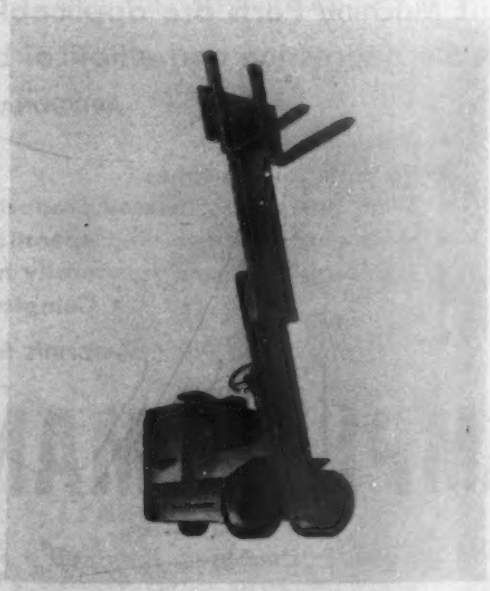
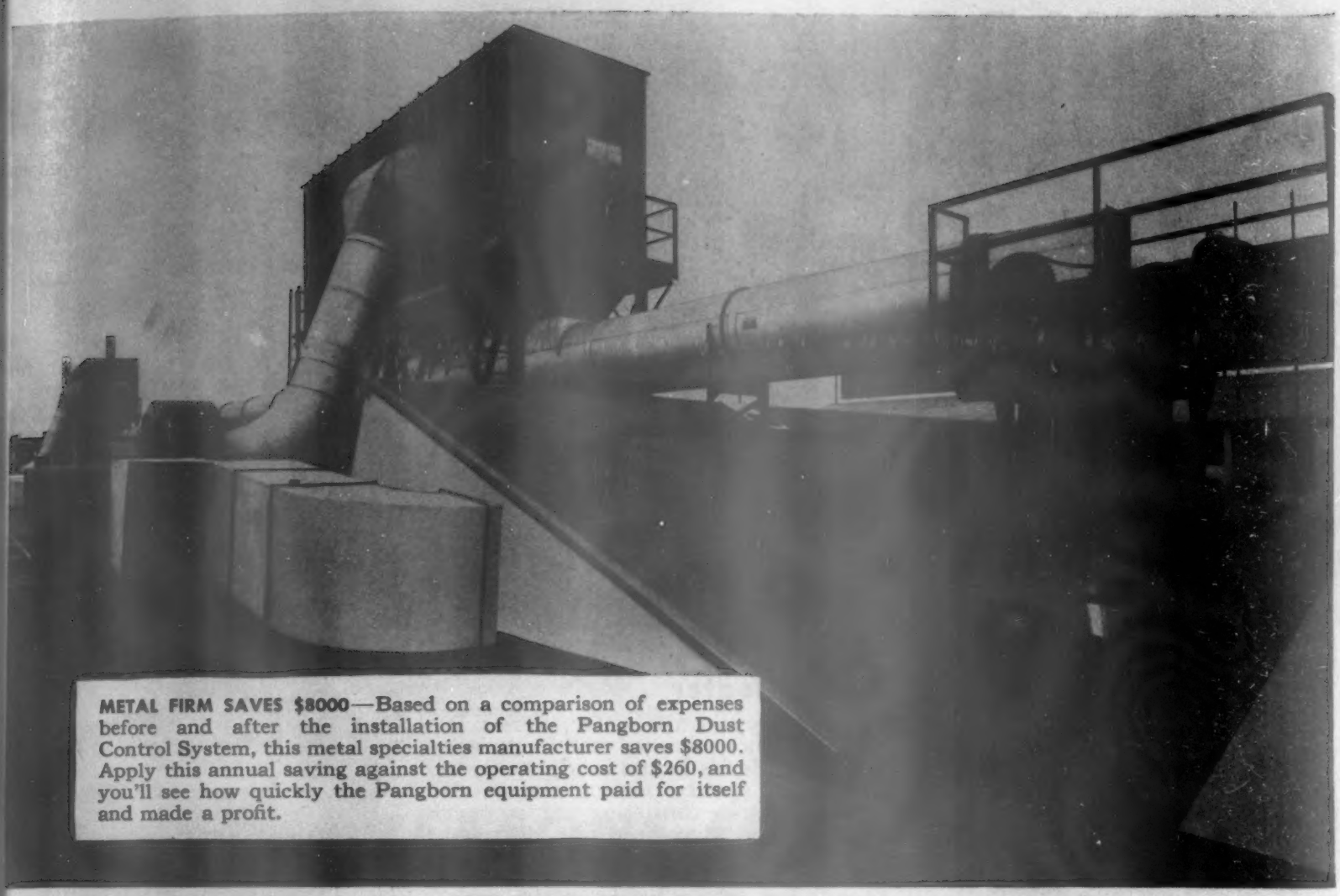


Fork Truck

Battery-operated fork truck, called the Transrider, has an over-all height of 83 inches. Unit can raise its load to 130 inches. Single lift before the telescopic uprights are extended is 66 inches. Capacity of the truck is 2000 pounds with a 48-in. load; 2500 pounds with a 36-in. load;



METAL FIRM SAVES $8000—Based on a comparison of expenses before and after the installation of the Pangborn Dust Control System, this metal specialties manufacturer saves $8000. Apply this annual saving against the operating cost of $260, and you'll see how quickly the Pangborn equipment paid for itself and made a profit.

METAL PLANT SALVAGES $5 DAILY!

This company salvages $5 worth of manganese dust per day with other savings of $1.50 per day. With low operating and maintenance costs, the Pangborn Dust Control System quickly paid for itself.

SALVAGES DUST FOR FUEL!

A musical instrument manufacturer salvages wood dust in his plant and burns it for fuel with an annual saving of $2500 on coal bills.

INCREASES QUALITY OF PRODUCT!

Soap manufacturer reports increase in product quality plus reduced plant maintenance. Salvage value of soap dust alone exceeds total operating and maintenance costs of Pangborn Dust Control System, thereby paying for equipment and making a profit.

For These Manufacturers . . .
PANGBORN turns Dust Losses into Dust Profits

YOU may look on industrial dust as a nuisance . . . but more probably you've found it to be an expensive liability. Pangborn Dust Control Equipment can help you decrease that dust loss liability, and in many cases, turn the tables and convert it to a new profit. At the left are several cases, taken from the hundreds of companies listed in the Pangborn customer file.

Whether your problem is to control dust to improve plant efficiency, recover by-products or increase product quality, Pangborn Dust Control Equipment can save you money, control an expensive liability. Write today for your *free* copy of "The Control of Industrial Dust." PANGBORN CORPORATION, 282 Pangborn Blvd., Hagerstown, Maryland.

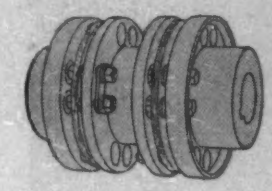
PANGBORN STOPS THE DUST HOG from stealing your profits

Look to Pangborn for all the Latest Developments in Dust Control and Blast Cleaning Equipment.

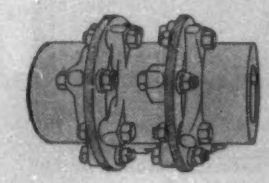
Pangborn
DUST CONTROL
TURNS DUST LOSSES INTO PROFITS

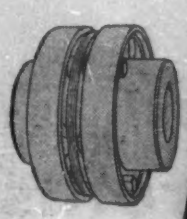
THOMAS Flexible ALL METAL COUPLINGS

Engineered to stand up on the toughest jobs, Thomas Flexible Couplings do not depend on springs, gears, rubber or grids to drive. All power is transmitted by direct pull.



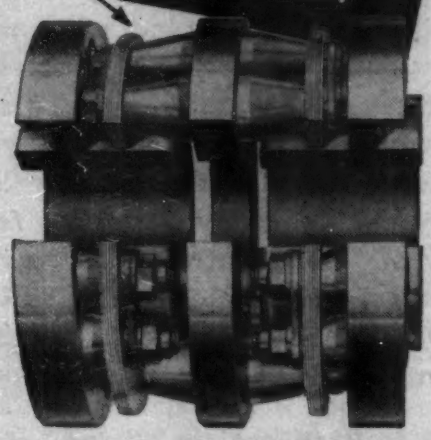
The standard line of Thomas Couplings meets practically all requirements. But if unusual conditions exist we are equipped to engineer and build special couplings.





BACKLASH FRICTION WEAR and CROSS-PULL are eliminated NO LUBRICATION REQUIRED!

PATENTED FLEXIBLE DISCS



THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT

Write for New Engineering Catalog

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

2850 pounds with a 30-in. load; 3000 pounds with a 28-in. load. Designed for maneuverability in cramped working quarters, truck has an overall length of 97¾ inches, 36-in. forks, and can turn in 57 inches. A right-angle turn can be accomplished in 71⅝ inches, plus the length of the load. Unit has three speeds forward and three reverse, automatic tilt of 10 degrees back and 5 degrees forward. Automatic Transportation Co., 149 West 87th St., Chicago.

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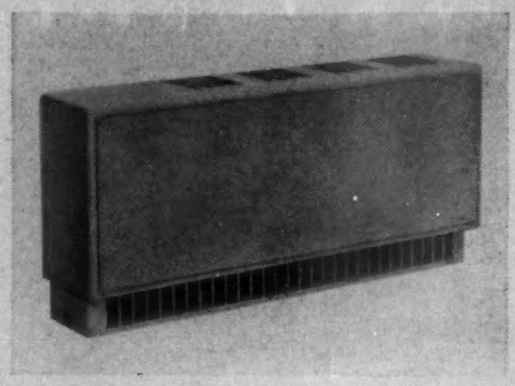

Unit Heater

Cabinet-type unit heater, Series R, is the successor to manufacturer's pre-war Series F, and is adjustable to a higher speed. Heating element is non-ferrous, consisting of copper tubing and aluminum fins. Element is of the hairpin cicuit type, with supply and return headers on one end, and return bends at the opposite end. Suitable for steam or forced hot water circulating systems. Heater can be equipped with an air filter, located beneath the heating element to filter entering air. Available in 4 sizes, with 1, 2, 3, 4, or 5 fans. Fans are forward-curved type, designed for operation at low tip speed, and are supported from rubber-mounted graphite-packed sleeve bearings. Standard motor is resilient-mounted, constant speed type, operating at 1725 r.p.m. V-belt drive with variable pitch motor sheave permits 30 per cent change in fan speed. John J. Nesbitt, Inc., Philadelphia 36.

•

Vertical Air Compressors

Vertical air compressor has the tank upright and the motor and air compressor unit mounted on top. Three models are available—25-V, which has a 20-gal. tank, 1½ c.f.m.; 50V, which has a 30-gal. tank, 2.7 c.f.m.; and 75-V, with a 30-gal. tank, 4.07 c.f.m. Model 25-V requires a floor area of 20 inches in diameter; the other two models need 24 inches. All three units are equipped with a single-phase motor that operates on 110 or 220 volts. Model 25-V has a ¼-hp. motor; 50-V, ½-hp.; 75-V, ¾-hp. All are equipped with pop-off valve and an adjustable automatic switch. The Grimes Co., Dallas.

•

Bushings

Reinforced molded bushings for electrical wiring systems are made for insulating conduit terminals. Can be used with insulating covers; are available in a complete range of sizes; and meet all Code requirements. Adalet Mfg. Co., 14300 Lorraine Ave., Cleveland 11.

•

Control Valve

Flow control valve, Model FC, is designed for accurate, automatic control of the speed of a cylinder piston stroke without affecting the power of the cylinder. It is positioned in the line between the operating valve and the cylinder, to regulate the speed of air being exhausted from the cylinder. For control of piston stroke speed in both directions, a valve must be piped into the line from both ends of the cylinder. Micrometer adjustment of a stem and floating bevel seat poppet are said to maintain this control at any selected speed. Variable speeds are obtainable by adjusting the valve screw. Valve handles air, oil, or water pressures, 0-1000 p.s.i. Six standard sizes—¼, ⅜, ½, ¾, 1, and 1¼ inch. Airmatic Valve, Inc., 1643 East 40th St., Cleveland.

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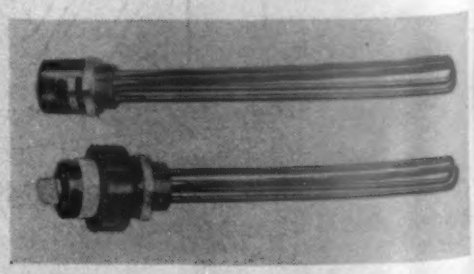

Screw-In Immersion Heaters

Electric immersion heaters with standard pipe-threaded screw plug.

Cities Service cutting oil specialists have helped make turret lathe production more profitable for many of our customers

In cam lobes grinding as in other grinding operations Cities Service Soluble fluids make fine finish possible with fewer rejects.

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Experienced users of cutting fluids generally agree that with correct tooling and the right type of cutting fluid they can usually count on the following gains:

- ★ **Longer tool life**
- ★ **Better finish**
- ★ **Closer tolerances, greater accuracies**
- ★ **Higher speeds per machine or operation**
- ★ **Produce more pieces between tool regrinds**

Why not find out what the right type cutting fluid will do for you?

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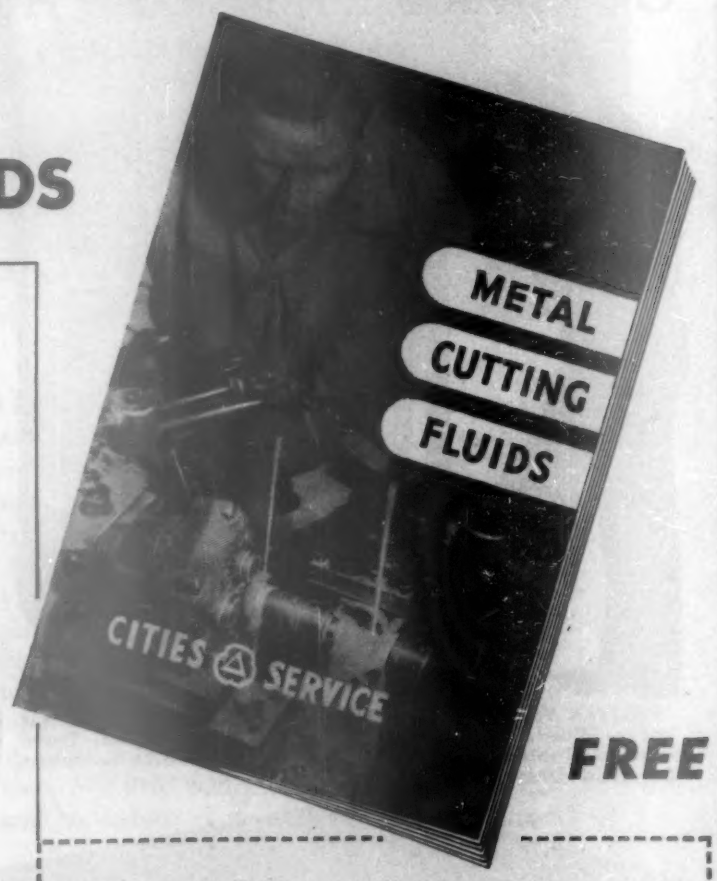

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Please send me without obligation your new booklet entitled "Metal Cutting Fluids."

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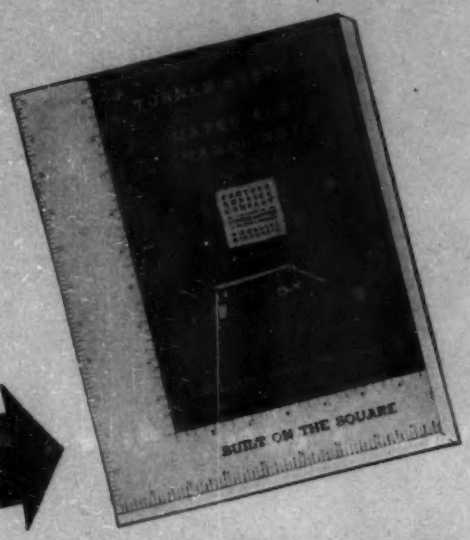
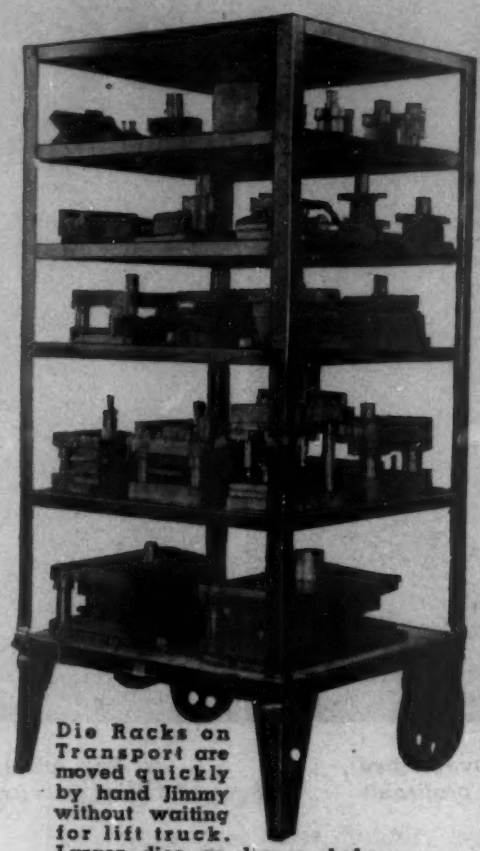
CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

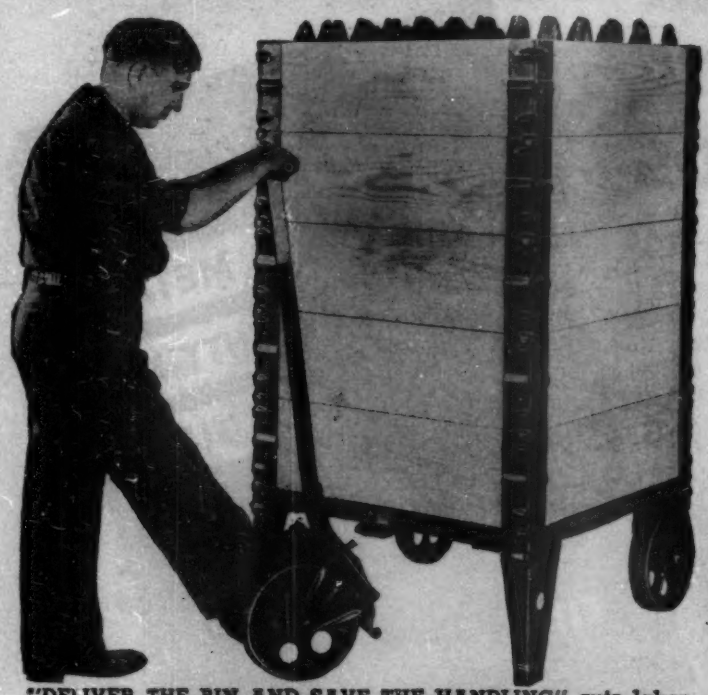


This Book Shows how YOU Can Save Money on Labor, Space and Equipment—with



Die Racks on Transport are moved quickly by hand Jimmy without waiting for lift truck. Larger dies on lower shelves, smaller dies on upper shelves.

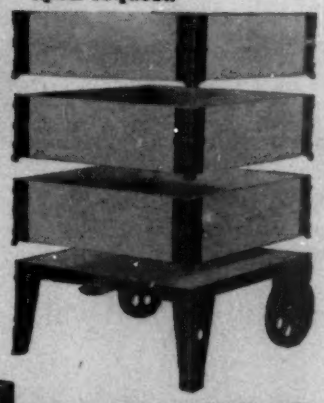
THE TURNER SYSTEM
OF MATERIALS HANDLING



For more than a quarter of a century the TURNER SYSTEM has been providing hundreds of leading manufacturers with the means of cutting labor, space and equipment costs. The chances are that it can do the same for you. It's important to you to find out about it NOW.

The TURNER SYSTEM book describes a plan for using a standardized series of interlocking and interchangeable units which can be applied at a saving to practically every plant operation. The book is sent without charge. No salesman will call, except upon request.

"DELIVER THE BIN AND SAVE THE HANDLING" cuts labor costs. Wooden-side or All-steel Bin Sections, Racks, Trays and Die Tables fit on the Turner Transport which is moved by hand Jimmy, power lift truck, crane or tractor.



BINS ARE ALWAYS THE RIGHT SIZE. Bin Sections are removed as load diminishes, added as load increases. No time wasted "diving" to bottom of over-size bin.

These new, rugged, 9-way accessibility Pallets bring you exceptional savings and increased efficiency. They stand up for years under hard use, stack on themselves and on other units.

Write Today for Your FREE copy of the Turner System Book and details of our 60 DAY Trial Plan.

FACTORY SERVICE COMPANY
4605 N. TWENTY-FIRST STREET MILWAUKEE 9, WISCONSIN

for mounting through tank walls are available with single or 3-heat switch built into the terminal end, or without switch for thermostatically controlled applications. The heating units have copper sheath and bronze screw plug with brazed joints for water heating, or steel sheath, forged-steel plug and welded joints for mineral or vegetable oils, and similar substances. Alloy sheaths are available for solutions that are corrosive to steel and copper. Single-heat units have one tubular element; 3-heat units have two, which can be connected in parallel or series to give full, ½, or ¼ wattage; 460-volt operation is possible by connecting the 2 elements of a 230-volt heater in series. Copper-sheathed heaters are available in 16 sizes, ranging from 600 watts to 10 kilowatts; 8 standard steel-sheathed heaters range from 1 to 6 kilowatts. Most of the heaters operate on 115 or 230 volts; 4 of the larger capacity units operate on 230 volts only. Edwin L. Wiegand Co., 7518 Thomas Blvd., Pittsburgh 8.

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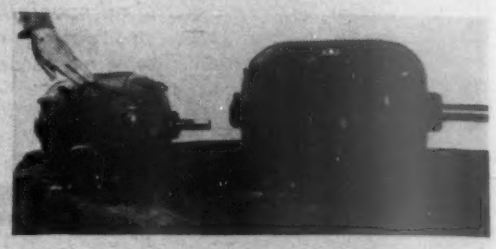

High-Temperature A.C. Induction Motor

Silicone resins for winding insulation and silicone grease for bearing lubrication are used on a totally enclosed non-ventilated motor in a 5-hp. 4-pole rating in the same frame sizes as those of open motors of the same rating. Manufacturer states that this permits reductions of as much as three frame sizes from standard Class A insulated totally enclosed motors, with the efficiency, power factor, and torque comparable to those for an open motor of the same rating. The accompanying photograph illustrates this size reduction, showing on the left manufacturer's 5-hp., 1750-r.p.m., 4-pole silicone-insulated motor in the 254 frame. Motor on the right is rated the same, but is Class A insulated and is in a 326 frame. By using silicone, the weight is reduced from 250 pounds to 145 pounds; height is reduced 3¼ inches; length, 7¼ inches. Westinghouse Electric Corp., 306 4th Ave., Pittsburgh 30.

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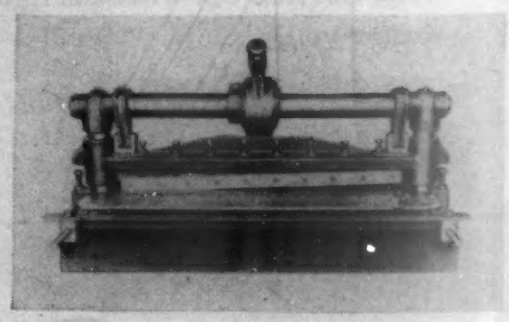
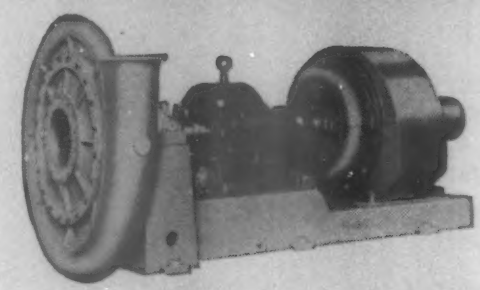


Shear

Cutting range of 24 in. shear, called Di-Acro, is said to extend from very light plastic, fiber, mica, leather, and rubber to heavy gages of aluminum,

The Solvay soda process was commercially perfected in 1864. Ten years earlier, the first "Roots" Blower was produced. We're not good because we're old . . . but old because we're good.

We give Chemicals a ride



From our standard sizes of Centrifugal and Rotary Positive Blowers, capacities are available from 5 CFM up, for separate or built-in application.

Rotary Positive Meters measure gases with cash-register accuracy, from 1,000 CFH to 1,000,000 CFH.

Most industries can profit from the experience of chemical processors in the use of Roots-Connersville equipment. Air, gas and solid particles are pushed or pulled through pipes by R-C Blowers and Vacuum Pumps. Mixtures are agitated and aerated. R-C Meters accurately measure gas input and output. Our Liquid Pumps move viscous liquids efficiently and economically.

For blowers, especially, we offer you an exclusive, important advantage. That is, our *dual-ability* to supply either Centrifugal or Rotary Positive units. Because we build both, we can recommend, without bias, the type which will do the job best. Only Roots-Connersville makes available this *dual choice.*

Our wide experience in the application of blowers and similar equipment is at your service. We help many industries to improve processes and products and to reduce costs. Consult us, without obligation.

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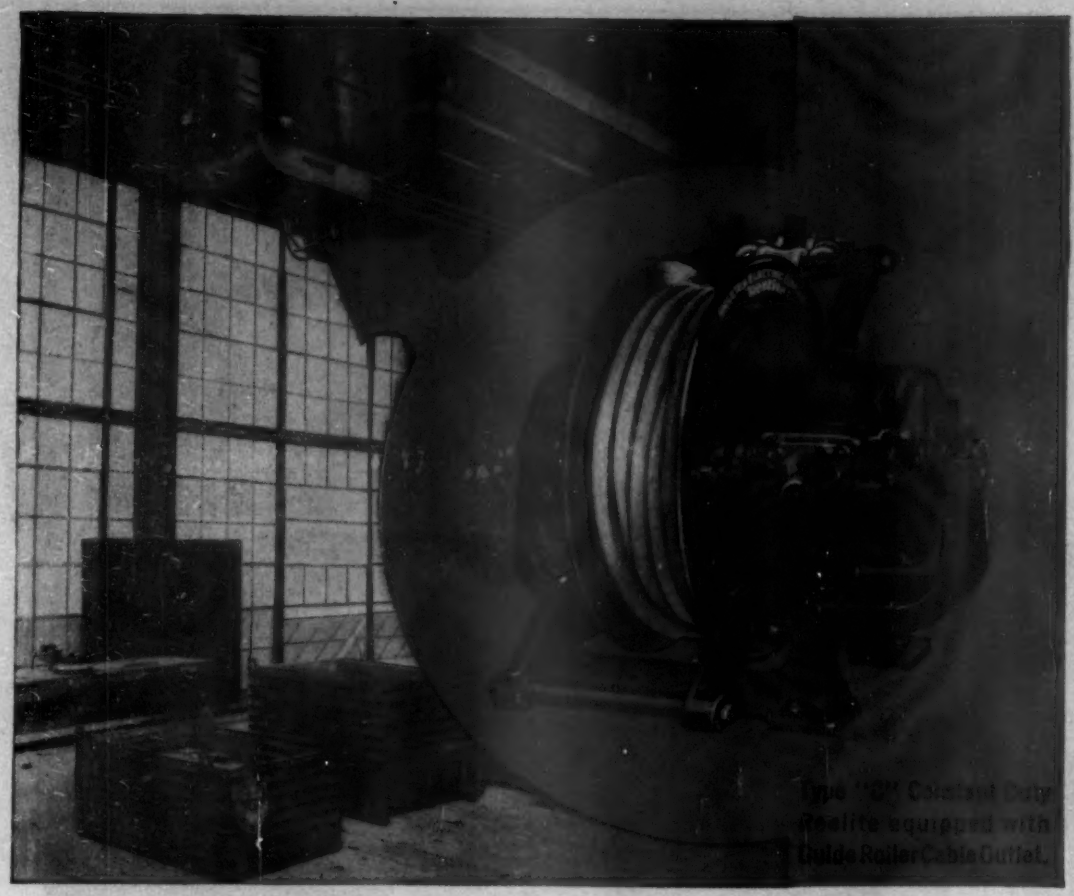
BLOWER BUILDERS · R-C · SINCE 1854

BLOWERS · EXHAUSTERS · BOOSTERS · LIQUID AND VACUUM PUMPS · METERS · INERT GAS GENERATORS

★ ★ ONE OF THE DRESSER INDUSTRIES ★ ★



CARETAKER OF ELECTRIC CABLE

CONSTANT DUTY

APPLETON REELITE

TRADE MARK

Keeps Conductor Cable Safe and Sound

Step up the pace of your mobile electrical machinery with Appleton Constant Duty Reelites—smooth-running caretakers of electrical cable that automatically take up and pay out cable connected to moving units. These ruggedly constructed Constant Duty Reelites hold the cable taut, eliminate kinks and tangles, prevent breaks—speed production and guard men and machinery against accidents.

Throughout American industry, thousands of Appleton Constant Duty Reelites see action every day on an endless variety of moving electrical machinery . . . lifting magnets, hoists, cranes, chargers, motor generator sets—much of the moving electrical equipment so vitally essential to profitable production. Appleton Reelites are manufactured in a variety of types and sizes to provide top efficiency on every job.

Construction of Appleton Reelites is dependable and strong. Ball-bearings eliminate undue wear and provide a lifetime of trouble-free reeling.

Sold Through Electrical Wholesalers

APPLETON ELECTRIC COMPANY

1715 Wellington Avenue • Chicago 13, Illinois

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SEND TODAY for 50-page Bulletin No. 504, giving complete technical details about all kinds and sizes of Reelites. Reelites for the transmission of air and fluids, Appleton Retract-o-Reels and Appleton Portable Reelites are also graphically illustrated and described in this free Bulletin. Further information on Appleton Reelites is listed in Sweet's File, Page 2a/15.

APPLETON

CONDUIT FITTINGS • LIGHTING EQUIPMENT • OUTLET AND SWITCH BOXES
EXPLOSION-PROOF FITTINGS • REELITES

cobalt steel, chrome molybdenum, leaded brass, and stainless steel. Features include a gravity chute, built into heavy base casting to deliver materials sheared; protracting gage, for squaring and mitering in numerous positions; material gage for accurate sizing of stock; adjustable stops to provide control of the shearing action and alloy tool steel shear blades, hardened and precision ground. O'Neil-Irwin Mfg. Co., 357 Eighth Ave., Lake City, Minn.

•

Jack

A 15-ton capacity jack, called "Shorty," designed for repairing cranes and for low-set loads, is 7 inches high, weighs 22 pounds. It is a ball-bearing screw jack, with a one-piece malleable iron housing, cut, heat-treated gears. Pinch bar end lever is 1⅛ inches by 36 inches long. Duff-Norton Mfg. Co., 2709 Preble Ave., Pittsburgh.

•

Gear Motor

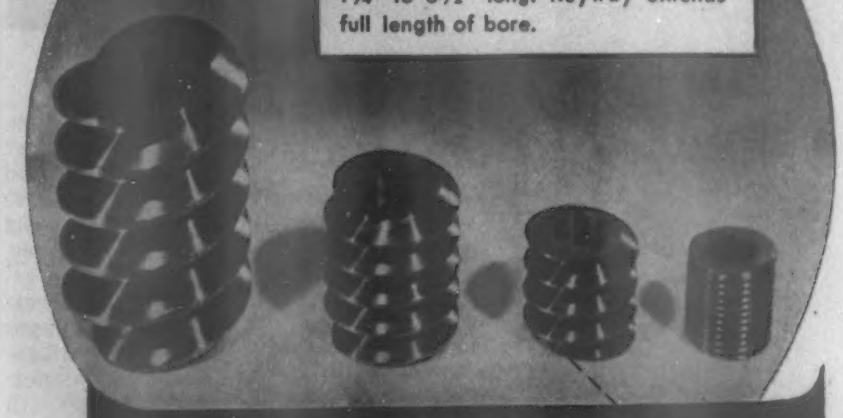
Compact gear motor with axial air-gap is available in ratings from ¾ to 10 horsepower. Units are symmetrical in design with no separate right- or left-hand assemblies. Motor may be removed from the gear housing and run separately. Unit employs two ratios of single helical gears with hardened teeth arranged in simple gear trains. Motor and gear shafts are parallel, with the centerline of the motor coinciding with the centerline of the low-speed shaft. Motor shaft rotates on ball bearings, gear shafts are mounted on tapered roller bearings. Oversized bearings on the low speed shaft allow for outboard pull from a sprocket gear or pulley that may be mounted in the shaft. Unit is suitable for horizontal mounting, preferably on a level floor, but provision can be made for wall,

NEW Sunnen Honing Process for bores with keyways

INCREASED PRODUCTION 10 TIMES on Internal Diameters of Worm Gears

. . . at Master Electric Co., Dayton, Ohio

Worm gears are made of SAE-1315 Steel, carburized and hardened to Rockwell "C" 62 to 70, sizes range from ½" to 1⅜" in diameter and from 1¼" to 3½" long. Keyway extends full length of bore.



Sunnen Precision Honing Machines are Versatile

- **Handle Wide Range** — Hone diameters from .120" to 2.625". Open or blind holes and bores with keyways.
- **Hone All Metals, Ceramics, Glass**—Steel, cast iron, bronze, brass and aluminum.
- **Produce Holes Accurate Within .0001"**—Sunnen-honing corrects out-of-roundness and distortion. Produces straight, round holes.
- **Produce Any Micro-inch Finish Required**—No high spots, chatter marks or other surface imperfections.

Write for information or, on request, a Sunnen engineer will be glad to show you the advantages of using Sunnen Honing in your plant.

SUNNEN

SUNNEN PRODUCTS COMPANY

7957 Manchester Ave., St. Louis 17, Missouri

Canadian Factory: Chatham, Ontario

Here Are the Facts—

These worm gears—with keyway bores — are Sunnen-honed to remove heat-treat distortion. Production rate is 150 parts per hour — production rate by former method, 12 to 15 parts per hour.

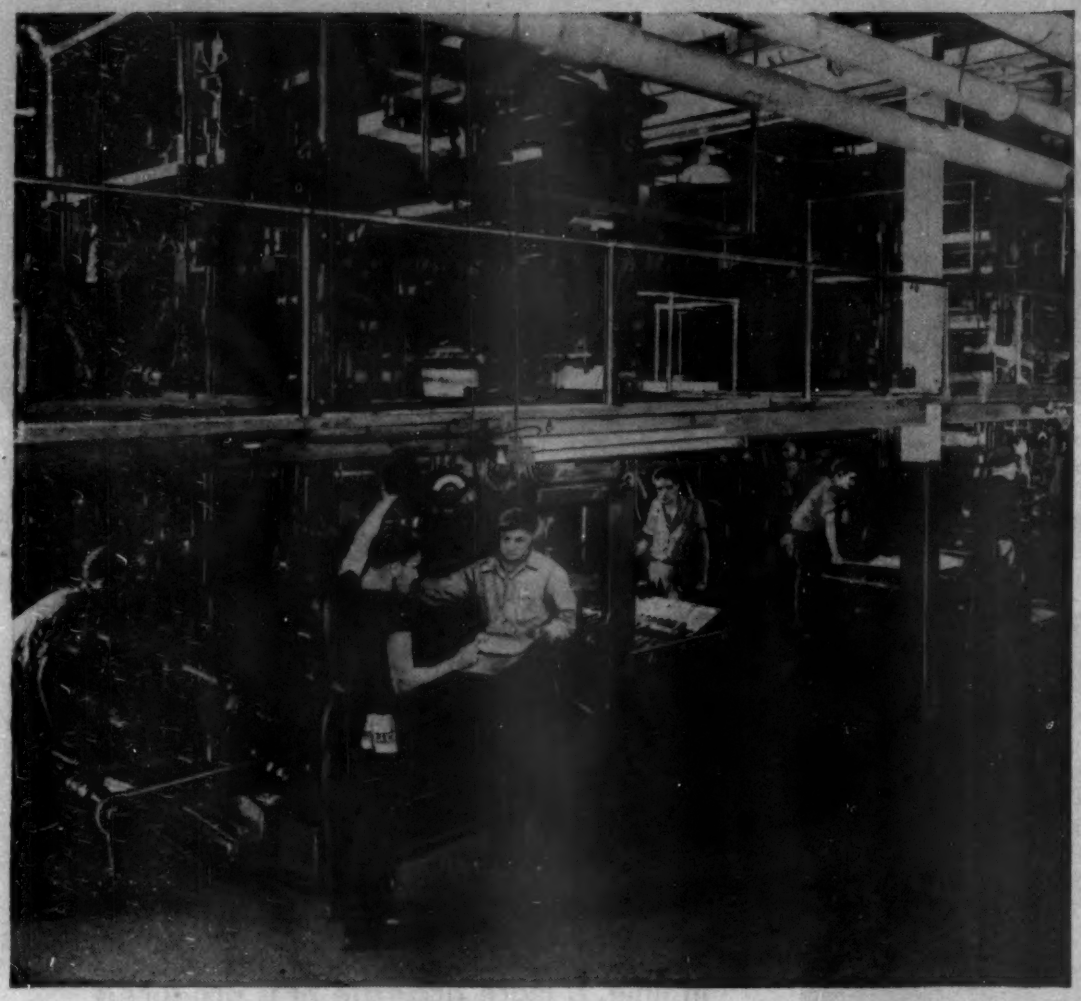
In addition to this tremendous saving in time, a more accurate fit is produced. Machine operators are pleased because Sunnen wet honing eliminates handling of hot parts, makes the job easier, and permits faster, easier, more accurate gauging of these gears.

Sunnen Precision Honing Machine in use at Master Electric Company.

SUNNEN PRECISION HONING

374

"KEX" Industrial Wiping TOWELS



...More Important Every Day to the
AMERICAN INDUSTRIAL SCENE

[View in McCall Corporation Press Room, Dayton, Ohio]

The reason—KEX Industrial Wiping Towels are produced especially for wiping. They are soft, with no harsh seams, no hidden buttons to mar delicate surfaces.

Every wiping towel is thoroughly cleaned and inspected before delivery to you. They come in neat, easily stored bundles that help you control distribution.

Follow the lead of industrial leaders who overlook no opportunity to keep operating costs down—and efficiency up.

Nothing to Buy—No Expensive Inventory—Just a Low Monthly Rental. The first month should show a decided saving on wiping costs.

For complete information, see your classified Telephone Directory for nearest KEX distributor, or write KEX NATIONAL SERVICE, 295 Fifth Avenue, New York 16, N. Y.

"KEX" NATIONAL SERVICE
REG. U.S. PAT. OFF.

ceiling, or angle mounting, provided shafts remain horizontal. Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago.

•

Lubricant

Heavy lubricant, known as Keystone Grease No. 32, for open gears subject to extreme service conditions, is said to be effective through temperatures ranging from subfreezing cold to its melting point, which exceeds 400 deg. F. Manufacturer claims that it repels water, even at boiling temperature. Packed in leak-proof paper cartridges which fit in gun applicators, grease is fed through the nozzle in a broad ribbon, so that it will reach the pressure side of gear teeth. May be applied when gears are in motion. Keystone Lubricating Co., 2132 Lippincott St., Philadelphia 34.

•

Electric Truck with Scoop

Electric power truck is equipped with a scoop for picking up, transporting, or piling loose materials. Scoop is attached to the truck's tilting and elevating mechanism. All controls are centralized at the driver's station. A tripping device on the scoop provides for discharge of the load. When it is lowered to floor level it assumes its normal shoveling position. Truck's upright column may be tilted forward 5 degrees,

Plymetl

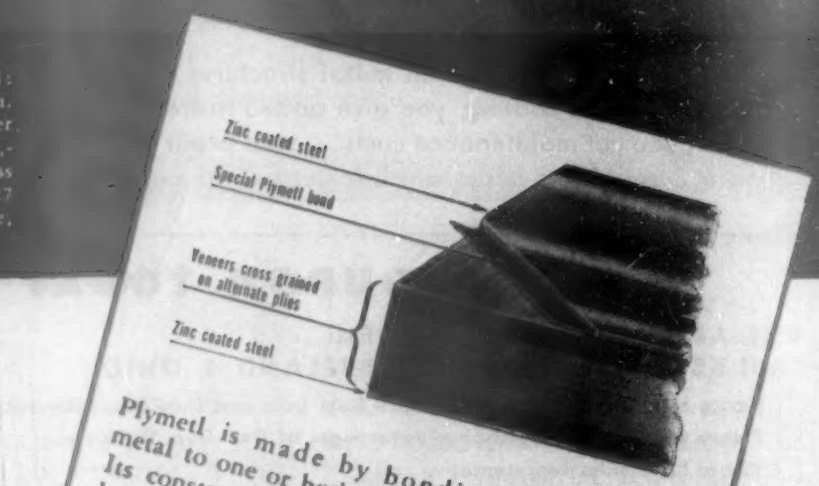
The material that's making news today

For over twenty-five years, Plymetl — a Haskelite material — has helped designers and engineers build greater performance, durability and sales appeal into their manufactured products. Its use eliminates deadweight, and makes complicated framing members and fastenings unnecessary. There is only one Plymetl . . . Haskelite Plymetl . . . with its performance proved. A material of many advantages, Haskelite Plymetl is easily worked with simple metalworking or woodworking tools. It can often save man-hours to a point where the final cost of the product may be noticeably reduced. The unique strength and weight characteristics of Plymetl are graphically described in the chart below. Write for complete data and samples of Plymetl.

	PLYMETL UVU			STEEL U.S. STD. GAUGES			ALUMINUM B & S STD. GAUGES		
	1/4"	5/16"	3/8"	20 ga.	16 ga.	12 ga.	10 ga.	8 ga.	6 ga.
Weight in lbs. per sq. ft.	1.01	1.17	1.43	1.5	2.5	4.37	1.44	1.81	2.28
Stiffness factor E I in. ^{2} lbs.	4,900	8,400	13,200	124	575	3,050	872	1,760	3,500

	PLYMETL EVE			STEEL U.S. STD. GAUGES			ALUMINUM B & S STD. GAUGES		
	1/4"	5/16"	3/8"	20 ga.	16 ga.	12 ga.	10 ga.	8 ga.	6 ga.
Weight in lbs. per sq. ft.	2.25	2.40	2.56	1.5	2.5	4.37	1.44	1.81	2.28
Stiffness factor E I in. ^{2} lbs.	17,000	28,000	43,000	124	575	3,050	872	1,760	3,500

In computing the values of Plymetl, the following is assumed: (1) The modulus of elasticity of steel, 30,000,000 lbs. per sq. in. (2) The modulus of elasticity of aluminum, 10,000,000 lbs. per sq. in. (3) The modulus of elasticity for the core material, 1,300,000 lbs. per sq. in. along the grain. 65,000 lbs. per sq. in. across the grain. (4) The thickness of steel and aluminum, .021" (27 ga.) and .015", respectively. (5) The weight of plywood plaque, 30 lbs. per cu. ft.



Plymetl is made by bonding thin sheets of metal to one or both faces of a plywood plaque. Its construction effects the most efficient distribution of these materials, combining high strength qualities of the metal surfaces with low density of woods. Result: Plymetl makes an ideal structural material, simulating an I beam with the metal surfaces taking the part of the flanges and the light weight plaque acting as the web.

Write for complete data and samples.

HASKELITE

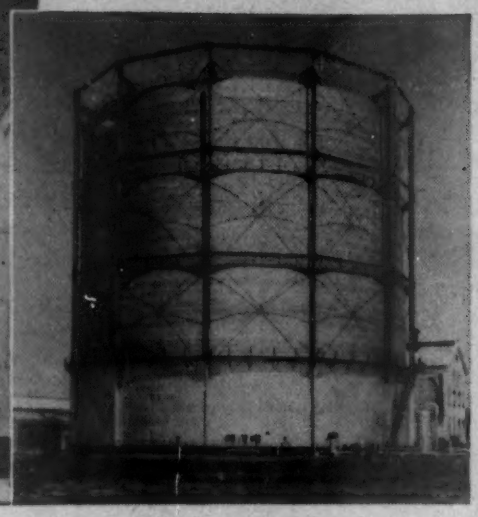
MANUFACTURING CORPORATION

Dept. MM, Grand Rapids 2, Mich.

New York Chicago Detroit
Boston St. Louis Philadelphia Los Angeles
Canada: Railway & Power Engineering Corp., Ltd.

Don't Let Rust and Corrosion Eat Away YOUR PROFITS!

Dum Dum for Metal being applied to the Gas Holder of the Pacific Gas and Electric Company.



The same Gas Holder completely finished with Dum Dum for Metal and protected for many years to come.

Dum Dum for metal gives long-lasting protection to METAL SURFACES

Dum Dum for Metal now offers the same long-term protection to metal surfaces that its famed companion product, Dum Dum Masonoc, has been giving for years to all types of masonry structures. More than a paint, Dum Dum for Metal is thick, tough, elastic . . . designed specifically to protect metal surfaces against the hazards of weather-wear, industrial fumes and gases. Stops those deadly enemies of metal structures . . . rust and corrosion.

When you cover your vital metal structures with this attractive aluminum colored coating, you give added lustre to your plant, but best of all you cut maintenance costs . . . stop profit leaks. Write today for your copy of this important booklet describing Dum Dum for Metal.

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THE ARCO COMPANY, Dept. FII
7301 BESSEMER AVENUE, CLEVELAND 4, OHIO

- ☐ Please send booklet describing Stack Dum Dum and Dum Dum Masonoc.
- ☐ Please send booklet describing advantages of Dum Dum for Metal.
- ☐ Please have sales representative call.

NAME _____

COMPANY _____

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CITY _____ ZONE _____ STATE _____

SPECIFY ARCO

THE ARCO COMPANY
CLEVELAND • LOS ANGELES

backward 15 degrees. Scoop can be loaded or emptied at floor level or at any height up to 117 inches. Its capacity is 12 cubic feet, 2000 pounds. Speed of truck, loaded, is up to 5½ m.p.h. Scoop is interchangeable with a standard type fork. Elwell-Parker Electric Co., Cleveland.

•

Tube Cutter

Tube cutter, No. 274-F, with ball-bearing action, is designed for use with copper, brass, aluminum, Bundy steel, block tin, and lead tubing, hard or soft temper. It will cut sizes from ⅛ to 1 inch O.D. Ball thrust bearings are built into the tool so that speedy size adjustment may be made. Rollers carry the tubing being cut. A flare cutoff groove in the rollers makes it possible to remove a cracked flare without waste of tubing. Retractable locking reamer folds out of way when not in use, and feed mechanism of tool is enclosed to protect threads against dirt and damage. Body is 4½ inches long, weighs 6 ounces. The Imperial Brass Mfg. Co., 1200 West Harrison St., Chicago 7.

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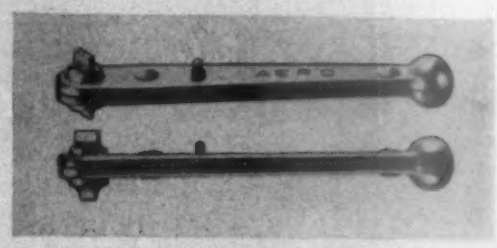


Screwdriver

Offset ratchet screwdriver, No. 5200, is designed to permit the application of leverage to drive screws, and to reach into difficult-to-reach areas. Reversing lever makes the tool suitable to drive or remove screws. Tool has two blades, one for large and one for small screws. It has a ball end grip to prevent injury to the hand. Over-all length is 3⅞ inches. The standard model is made for slotted screws only; however it is available with special drivers for Reed & Prince, Phillips, and other screws. Aero Tool Co., 6930 Avalon Blvd., Los Angeles 3.

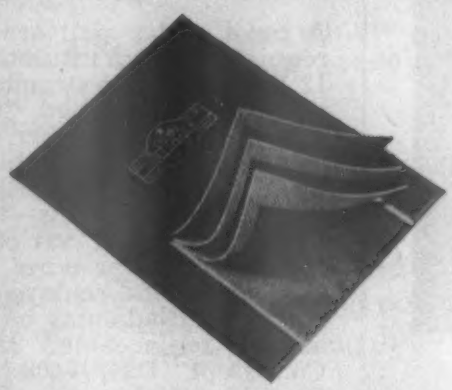
•

Lift Truck

Gasoline-powered fork lift truck, called Transitier, is designed for high speed loading and unloading of trucks and railroad cars. Full pneumatic tires allow fast travel on bumpy roads or uneven platform sur-

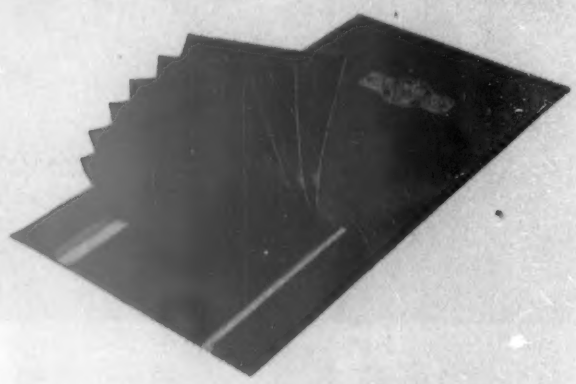
Transmission Belting by Thermoid

The two grades of belting described here, cover the maximum range of industrial applications. Your Thermoid distributor will be glad to recommend the size and number of plies best suited to the particular service you have in mind.



For severe service, high speeds, small pulleys use Thermoid High Speed R*

Made of extra strong, hard, 35-ounce duck combined with top grade natural rubber friction and skim. This belt is extremely strong, flexible, and has a minimum amount of stretch. The square edges are protected by a sealing compound. All plies are straight-laid. Since there are no folds or seams, each ply carries its full share of the load. Supplied in cut or continuous length up to approximately 500 ft., or continuous wind endless, in all standard widths and any number of plies.



For regular service use Thermoid #400

A high-quality, brown-colored belt of finest 32-ounce fabric. This belt withstands severe flexing and shock loads. It is of folded-edge construction with a strong skim stock between the plies. Supplied in continuous lengths up to approximately 500 ft. in all standard widths and any number of plies. Also supplied endless with stitched diamond splice.

*This Thermoid High Speed R (Diagonal) when oil or grease is present.

It's good business to do business with Thermoid

You will like the personalized attention you get from Thermoid distributors, and you will appreciate the speed with which a specific problem can be handled by our distributors in conjunction with our sales engineers. Thermoid concentrates on a well-integrated line of industrial rubber products and friction materials, and is unusually well equipped to service your requirements.

The Thermoid Line Includes:
Transmission Belting • F.H.P. and Multiple V-Belts • Conveyor Belting • Elevator Belting • Wrapped and Molded Hose • Custom Molded Products • Industrial Brake Linings and Friction Materials.

Thermoid

Thermoid Company • Main Offices and Factory • Trenton, N. J., U. S. A.
Western Offices and Factory • Nephi, Utah, U. S. A.
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Production Machinery.....

NOT just auxiliary equipment

Logan Apron Conveyor, moving at a fixed speed, constitutes the basis for an efficient assembly line for coal and wood heaters in a nationally-known plant. Final parts manufacturing operations are completed in the far rear and heaters are then assembled at eight stations along the conveyor run. Apron conveyor discharges to Logan Rollers in foreground, which lead to packing and shipping operations.

"Catch-as-Catch Can" production has been replaced in many industries by orderly movement of raw materials and parts-in-process, through practically every stage of manufacture, assembly, packing and shipping via Logan Conveyors.

Materials are fed to machines, or to processes, in a continuous flow, thus permitting full-time use of the facilities . . . no waiting for "the next batch" of material. And since deliveries are made to operators at convenient working height, there is no time-wasting and fatiguing lift, bend and stoop for shop personnel. In this way, Logan Conveyors have become an integral part of production machinery . . . not just "auxiliary equipment."

Probably Logan can help you lower manufacturing costs by improving production flow in your plant. Write for literature.

SINCE Logan 1876

Logan Conveyors

LOGAN CO., INC., 510 CABEL ST., LOUISVILLE 6, KY.

faces. All-welded one-piece body frame is constructed of heavy-gage steel stampings; four-cylinder water-cooled Cobra engine develops 26 horsepower; 61-in. turning radius facilitates maneuverability in narrow-aisle, congested warehouses. Load carry mast is hydraulically operated. Clutch is located behind and above the engine for easy accessibility; operated hydraulically it can be adjusted or completely changed in 15 minutes, according to the manufacturer. Weight of the 1-ton model is approximately 2000 pounds. Lift heights of 5, 7, and 9 feet are available. Transitier Truck Co., Portland, Ore.

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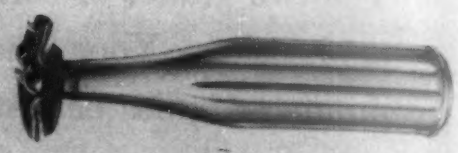


Wire Stripper

A twist and a pull are all that are required to strip insulation from Nos. 12 to 22 solid or stranded wire with wire stripper called "Quick-Strip," according to the maker. Tool consists of a round, hardened blade attached to a plastic handle. Blade contains four calibrated slots—three accommodate wires of various sizes, the fourth cleans the wire. May also be used to cut and remove braided wire shielding. Blade may be resharpened, and is replaceable. Jaco Products Co., Dept. D24, 6408 Euclid Ave., Cleveland.

•

Dehumidifier

Designed to remove moisture from the air automatically and hold relative humidity at a predetermined level, Dryomatic Dry Conditioner first filters the air and then absorbs the moisture. Moisture is blown off in the form of saturated air so that there is no condensation and no need for drainage. It is claimed that unit serves to inhibit rust and corrosion in tool and stockrooms; it may be used to protect perishable materials from mold and moisture damage, to keep crystalline materials from caking or deliquescing, and to protect testing instruments. Unit is about

ANNOUNCING . . .

SQUARE D *Electronic* CONTROL FOR HIGH-PRODUCTION SPOT WELDING

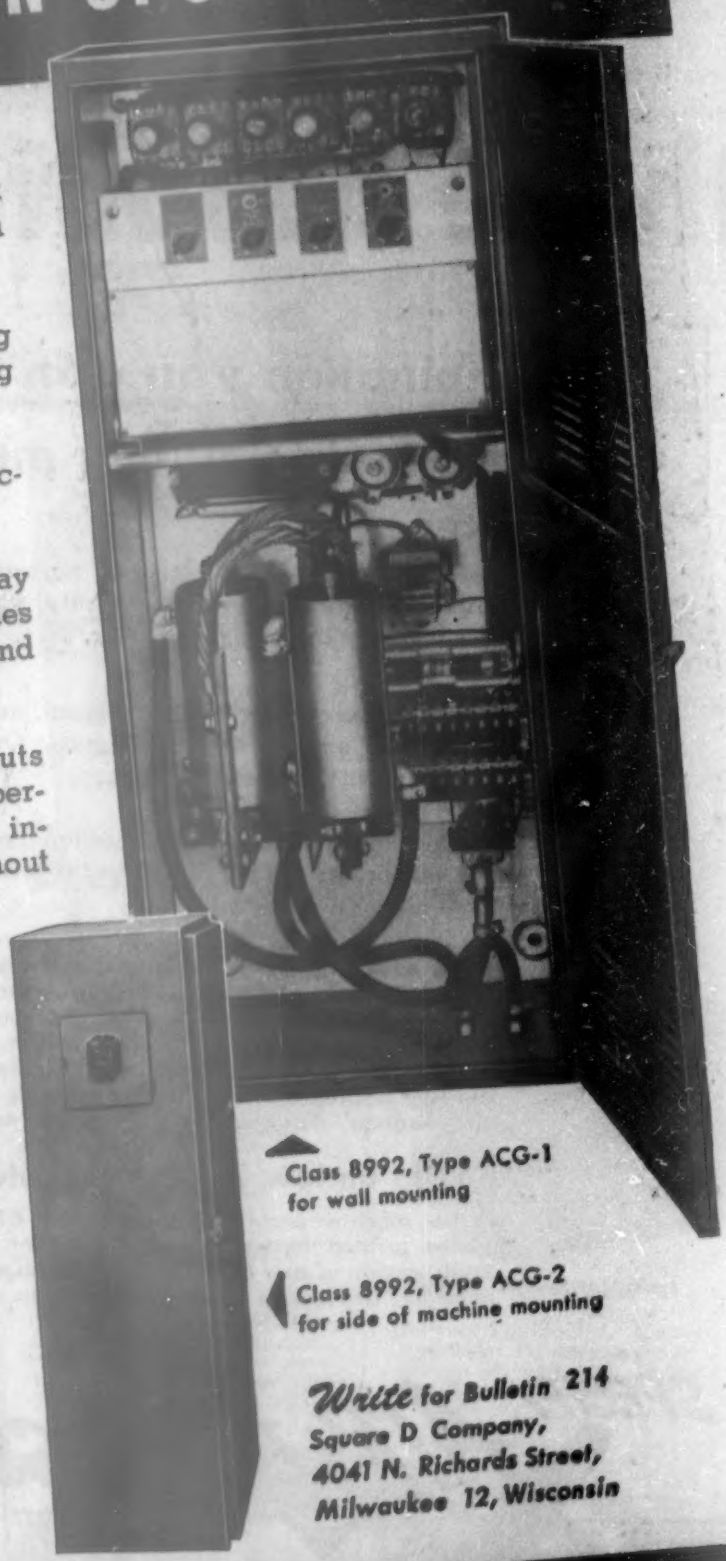
NON-SYNCHRONOUS COMBINATION UNIT . . . one enclosure houses an electronic contactor to make and break power circuit and a timer to govern weld duration and electrode motion.

SPEED • Up to 400 welds per minute. No sequencing relays. Simple six tube circuit cancels out operating delays of valve and firing relays.

ACCURACY • Regulated DC timing circuits insure accuracy over wide range of line voltage variations.

CONSISTENCY • Timing circuit coordinates firing relay operation to give consistent starting point and full cycles of welding current, thus avoiding high transients and transformer saturation.

LOW MAINTENANCE • Industrial construction cuts "down"-time, simplifies servicing. Disconnect plugs permit instant exchange of timer panels. Entire timer, including power supply, is removed in one piece without disturbing external connections. Two ¼ turn fasteners release swing-down panel making all components and circuit tie points instantly accessible at screw terminals.



Class 8992, Type ACG-1 for wall mounting

Class 8992, Type ACG-2 for side of machine mounting

The BEST Resistance Welder Control?

● There is no one type. Square D builds both magnetic and electronic controls of many types—each best suited to certain types of applications. Specify Square D, and be sure of getting the best for your job.

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21½ inches high, 14¾ inches in diameter. Operation is automatic and installation may be made wherever 110 volts a.c. is available. Dryomatic Corp. of America, Baltimore.

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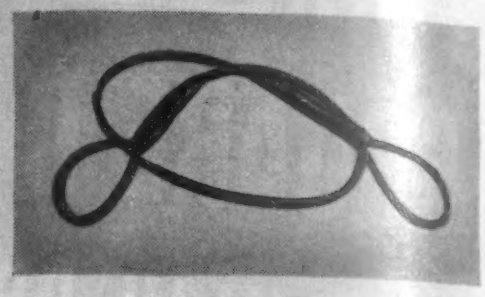

Wire Rope Sling

Made of improved plow-steel, wire rope slings have two 6-in. loops spliced in and sewed with tape for maximum safety in ordinary and specialized lifting operations. Wires are of six strands, 37 wires to the strand. Slings are made in four ⅛-in. rope diameters from ⅜ to ¾ inch in standard 6-ft. lengths. Extra lengths can be supplied. Palmer-Shile Co., 16007 Fullerton Ave., Detroit 27.

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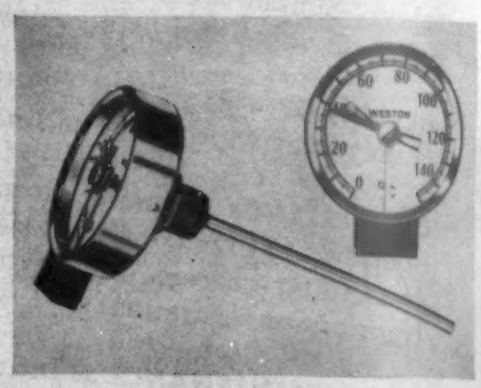


Contact-Making Thermometer

Combining the features of an indicating thermometer with an alarm or control device, contact-making thermometer consists of an all-metal thermometer with an adjustable contact arm mounted in the glass and bezel. Screw-type terminal block mounted on the periphery of the cast front provides for electrical connection. Contacts are of the magnetic type, and the contact arm may be set to make contact at any temperature. Contact can be broken manually after an alarm has been sounded; the contacts break automatically on a temperature change of approximately 5 per cent.

Can be supplied to make contact on either increasing or decreasing temperature. Stem lengths available from 2½ to 24 inches, longer on special order. Weston Electrical Instrument Corp., 617 Frelinghuysen Ave., Newark 5, N. J.

•

Paper Plates

Available in bulk for in-plant feeding, two lines of pastel-colored paper plates are made in a fluted style to provide a deep plate. The Bondware line of 9-in. plates is made in green, rose, canary, blue, and white. Plates have a smooth, hard surface of sulphite-lined board. The Thriftware

CHECK TOLERANCES

FROM "TENTHS" TO "HUNDREDTHS"

BY SIMPLE TURN OF GRADUATION SELECTOR

Only Brown & Sharpe Electronic Measuring Equipment offers this advantage

By the simple turn of a graduation selector, you get accurate readings in the desired increment from .0001" to .00001", on Brown & Sharpe Electronic Measuring Equipment. No further manipulations! The amplifier unit below shows the range. In addition, intermediate settings can be made easily to match prescribed tolerance limits.

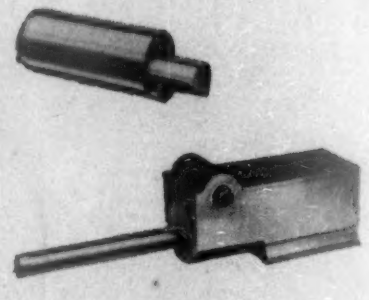
The *true linear response* of the amplifier permits accurate calibration of scale graduations. Its versatility particularly simplifies special applications in production inspection and sorting devices.

Other exclusive advantages of Brown & Sharpe Electronic Measuring Equipment include a simple, self-checking device on the External Comparator . . . no gage blocks needed . . . and a constant zero setting regardless of changes in increments of measurement. Investigate all advantages of this quality-control aid. Write for Bulletin. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

We urge buying through the Distributor

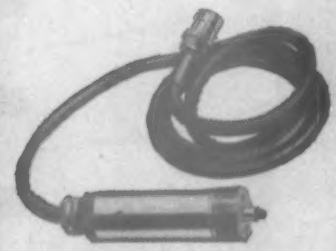
External Comparator No. 951

Range, 0-4". Simplified setting. One master only. Reversible anvil. Self-checking. Shock-protected. Diamond gaging point.



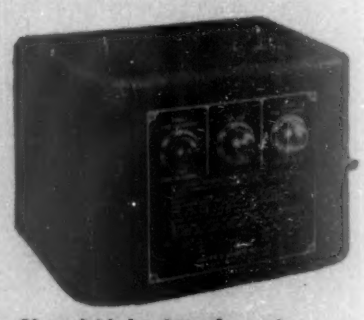
Internal Comparator Attachment No. 952

Range ½" to 2". Frictionless. No pivots to wear. One master only. One measuring point and measuring bar serve any plug.



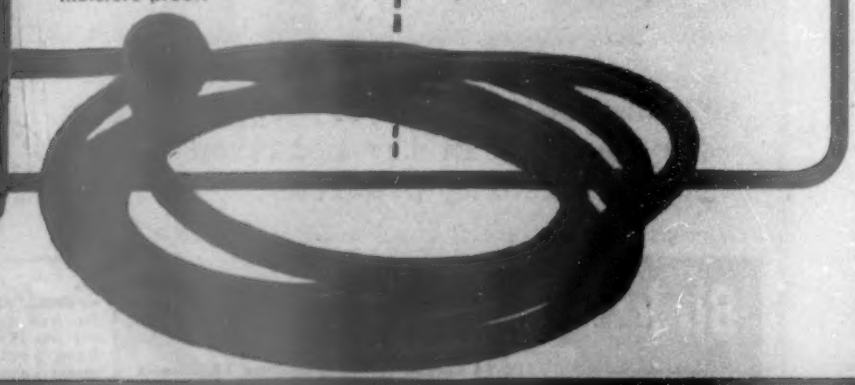
Gage Head Cartridge No. 953

For mounting in jig or fixture. Its range of measurement is .002" with a small added over-travel which measuring point makes. Frictionless. Dust and moisture proof.



Signal Light Attachment No. 958

Optional Equipment. Speeds operations. Provides visual indication of work size. Easily and securely attached.



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for better finishes use

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● cuts rejects and refinishing

● stops customer complaints

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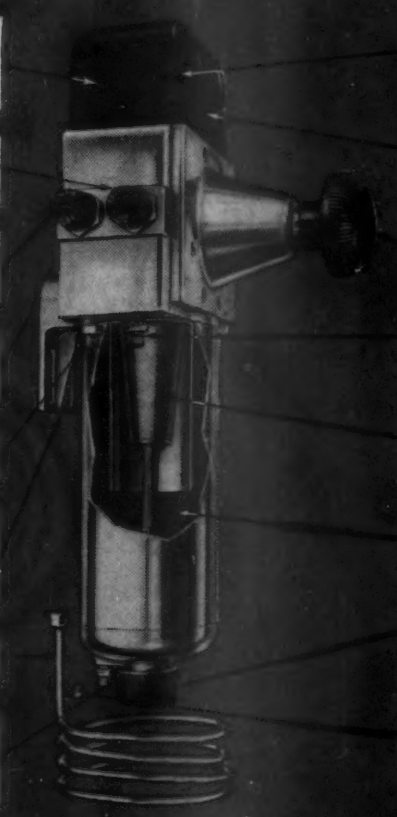
There are no filter packs to buy or renew, no time lost obtaining or replacing them. The special metal filter (heart of the unit) is easily cleaned, lasts indefinitely. There are no moving parts. The E-75 drains itself when the air supply shuts down. A manual drain is also provided.

There is a Binks oil and water extractor for every size operation. See Binks catalog for full information.


Easily Removed Plastic Covering For Pressure Gauges
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Connection for Semi-Automatic Drain Tube
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Main Line Air Pressure Gauge
Regulator Knob
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"Binks welcomes every opportunity for service in the solution of your finishing problems."

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line is available in the same colors, size, and style, but is not sulphite lined. Bowes Industries, Inc., 1 North LaSalle St., Chicago.

•

High-Current Transformer

Portable, high-current transformer is claimed to eliminate error-causing effects of stray magnetic fields from the same or other circuits. Unit accuracy is reported at plus or minus 0.1 per cent; has 5-min. phase angle over the current range from 10 to 150 per cent at burdens up to 0.5 ohms (ASA standard B-0.5). Device has eight current ratings from 1000 through 4000 to 5 amperes secondary current. Weight is about 130 pounds, and carrying handles are provided. Terminals are for either cable or bus bar connection. Westinghouse Electric Corp., 306 Fourth Ave., Pittsburgh 30.

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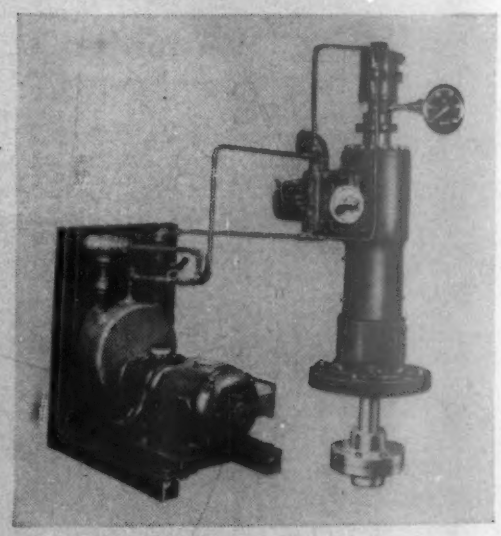

Variable-Speed Hydraulic Drives

Line of application-engineered variable-speed hydraulic drives uses pumps and motors of the Rotocycle design as the hydraulically coupled activating mediums. Motors may be remotely located from pumps and the hydraulic circuit arranged so that several motors are supplied with fluid pressure from one central pumping source. Governing system, called Hydro-syn, is used to maintain a constant predetermined speed, by adjusting a main circuit control valve. This speed is then maintained by a separate hydraulic control circuit which operates on the con-

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HERE'S A SIMPLIFIED SYSTEM THAT WILL HELP YOU

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. . . prolong the life of your equipment

. . . *save money* on repair and replacement costs

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Kardex Visible Maintenance records automatically indicate items requiring attention, enabling you to route maintenance men at the proper times to the proper machines *to do a definite job*—thereby eliminating lost motion and wasted effort. With Kardex you get a complete, compact "picture" of each machine: point and type of lubrication are high-lighted; needed adjustments and parts replacements are shown; tabulation is provided for noting pre-scheduled inspection dates, which are in turn signaled graphically on the visible margin — these and all other facts needed for systematic, money-saving maintenance operation are incorporated in this *one* Visible record.

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Your Remington Rand representative has available for your benefit analyses and descriptions of actual Preventive Maintenance Systems developed for manufacturing concerns in a variety of industries. He will also furnish details on Remington Rand Records Installation Service —your way of avoiding upset and confusion when changing over to new, simplified systems. Call him today or write Systems Division, 315 Fourth Avenue, New York 10, N. Y.

the CHART *that* THINKS

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KEEPS INVENTORIES OF PARTS AND SUPPLIES IN BALANCE—shows when each item should be reordered and in what quantity.

SIMPLIFIES ORDERING—all facts needed for effective ordering and economical shipment are assembled in one compact record.

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1873 THE FIRST TYPEWRITER 1948 — 75th ANNIVERSARY — REMINGTON RAND

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THE FIRST NAME IN BUSINESS SYSTEMS

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MILFORD FLEXIBLE REZISTOR

is now made better than ever with M-2 high speed steel

This modern post-war steel means even *more* cutting . . . even *faster* cutting . . . for this outstanding blade which has been replacing all-hard blades with mechanics everywhere.

The same *safe* cutting, because it's shatter proof! The same *economical* cutting because there's no accidental breakage! Only the teeth are hardened . . . the back is tough and flexible. And the same *easy* cutting because of MILFORD'S exclusive Easy Starting Teeth.

This improved performance is typical of MILFORD'S continuous research, test and experiment. As better metal-cutting saw blades are made, MILFORD is making them!

Order from your mill supply distributor. He is always ready to serve your needs for all factory and mill supplies, as well as **MILFORD** hack saw and band saw blades.

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PROFILE AND BAND SAW BLADES
REZISTOR AND DUPLEX HACK SAW BLADES
Saw Specialists Exclusively for Over 70 Years
NEW HAVEN 5, CONNECTICUT, U. S. A.

stant pressure differential principle through a pilot valve. Manufacturer states that the system can be used to maintain any predetermined condition of speed, torque, pressure, volume, or liquid level. Drives can be furnished in speed ranges up to 5000 r.p.m., and in ratings from fractional to 125 horsepower or greater. Hydraulics Div., Rockwell Mfg. Co., 50 Water St., Pittsburgh 22.

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Hose Clamp

Spring tension design of self-tightening hose clamp permits it to be squeezed open with pliers, slipped over the connection, and released. It closes about the hose automatically, forming a flexible seal without need for any bonding compound, according to the manufacturer. Unit is of one piece, shaped from rounded stock to eliminate sharp edges. Made of cadmium-plated heat-treated steel, it is suitable for use wherever rubber or fabric hose must be connected to metal tubing to carry air, gases, or liquids. Fits hose with outside diameters from 7/16 to 2⅝ inches. Corbin Screw Div., American Hardware Corp., New Britain, Conn.

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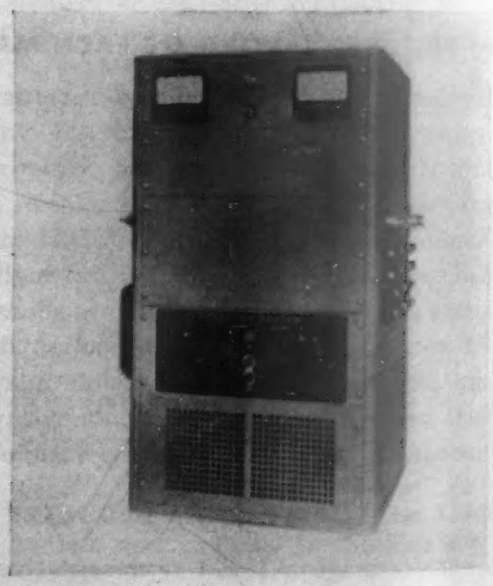


High-Amperage D.C. Rectifier

Power-supply units, called Multi-Rectifiers, are designed for operation from 220- or 440-volt, 3-phase, a.c., and feature flexibility in d.c. output. The MR1, a standard model, incorporates six selenium rectifier sections which may be interconnected to provide a choice of four d.c. ranges

—0-8 volts, capacity 100 amperes; 0-16 volts, to 50 amperes; 0-24 volts, 35 amperes; and 0-48 volts, 18 amperes. Manufacturer states that the output at any voltage and current has a ripple content of only about 5 per cent. W. Green Electric Co., Inc., 130 Cedar St., New York 6.

•

Direct Fired Unit Heaters

Designed primarily for heating and ventilating buildings, unit heaters can also be used for process work and for make-up air applications. Fuel can be oil, gas, or coal. Capacities range from 300,000 up to 3,000,000 B.t.u. in the gas- or oil-fired unit. Stoker fired, the range includes 500,000 up to 2,000,000 B.t.u. A third type, the Central, is built in capacities from 2,500,000 up to 6,000,000 B.t.u. This type can be used with stoker, heavy oil, gas, or other type of fuel. Other features include 4-pass gas travel, separate induced draft fan, and placing of bearings on outside of heater to facilitate maintenance. Arthur A. Olson & Co., Canfield, Ohio.

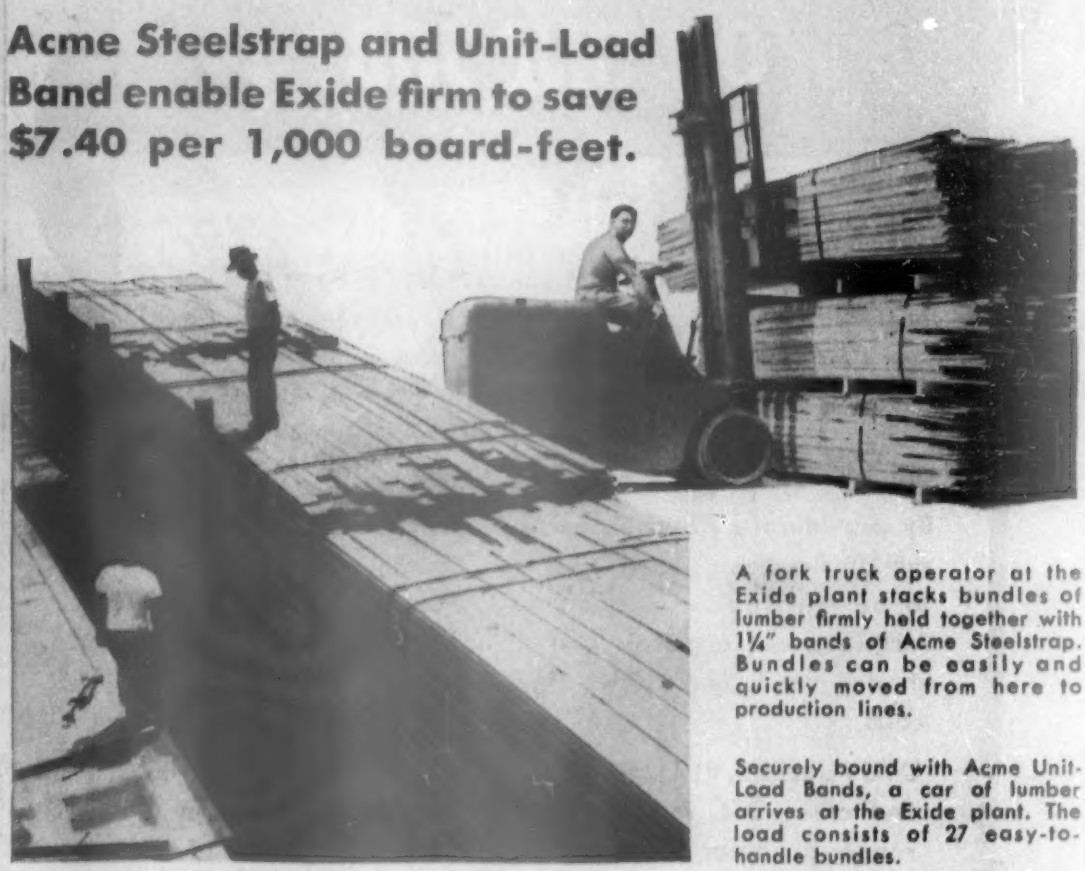
•

Manual Starting Switches

For use with fractional-horsepower motors, line of five types of manual starting switches includes models with general-purpose enclosure; without enclosure; combination unit and selector switch; with cast iron

How Battery Maker Cut Lumber Handling Costs 65%

Acme Steelstrap and Unit-Load Band enable Exide firm to save $7.40 per 1,000 board-feet.



A fork truck operator at the Exide plant stacks bundles of lumber firmly held together with 1¼" bands of Acme Steelstrap. Bundles can be easily and quickly moved from here to production lines.

Securely bound with Acme Unit-Load Bands, a car of lumber arrives at the Exide plant. The load consists of 27 easy-to-handle bundles.

The Electric Storage Battery Company of Philadelphia, makers of the famous Exide Battery, decided that the process of unloading lumber from boxcars board by board was too slow and too costly.

After a survey by an Acme Shipping Specialist, they asked their suppliers to ship them crating lumber strapped in bundles "Bound to get there" with Acme Steelstrap. Then the bundles were loaded onto flatcars and held firmly together with Acme Unit-Load Band.

The result was a reduction in costs of fully 65%! Two men and a fork truck took only 8 man-minutes per 1,000 board-feet to unload the lumber and move it to storage. Moving bundles out of storage proved to be just as fast.

The saving amounted to $7.40 for every 1,000 board-feet handled, and was achieved despite additional loading charges at the mills. Company now specifies shipment by Unit-Load methods on every purchase order.

Why not find out what Acme Steelstrap and Unit-Load methods can do for your business. An Acme Shipping Specialist will gladly make an analysis for you without cost or obligation. For further information, mail the coupon below.

Doc. Steelstrap

STRAPPING DIVISION
ACME STEEL COMPANY

Acme Steel Company, Dept. FM-118
2838 Archer Avenue, Chicago 8, Illinois
Please send me a free copy of your booklet, "SAVINGS IN SHIPPING."

Name_____
Company_____
Address_____
City_____ Zone____ State____

Acme Steelstrap — ACME STEEL CO. CHICAGO

NEW YORK 17 ATLANTA CHICAGO 8 LOS ANGELES 11

OTC PULLERS
OFTEN SAVE THEIR COST
ON ONE JOB!

The OTC PULLING SYSTEM solves MANY difficult jobs encountered in repairing or overhauling big machinery such as heavy machine tools, turbines, generators, marine engines, road machinery, and other heavy equipment. OTC Parts Pulling Engineering Service is available through OTC Distributors.

By providing a positive non-slipping grip and a powerful pull on flywheels, gears, bearings, pulleys and other parts to be removed or installed, OTC PULLERS and ATTACHMENTS avoid accidents and damage to expensive parts, shorten production "down time" and reduce maintenance costs.

OTC PULLERS, PULLER ATTACHMENTS, BOX WRENCHES and other OTC Maintenance Tools are made in a wide range of types and sizes to fit different requirements. Approved by all leading bearing manufacturers.

OTC INDUSTRIAL MAINTENANCE SETS offer highly versatile, universal OTC Pulling Equipment at minimum investment . . . for use in factories, mills, mines, railroad shops, shipyards, utility plants, etc.

ASK YOUR OTC DISTRIBUTOR SALESMEN
or write for OTC Maintenance Bulletin PE-1946

OWATONNA TOOL CO.
363 CEDAR ST. OWATONNA, MINN.

LOOK FOR THIS SIGN AUTHORIZED DISTRIBUTOR OTC MAINTENANCE TOOLS

enclosure for wet locations; and a similar type for dusty or hazardous locations. All five types have rust-resistant parts, molded base of moisture-resisting insulating material which mounts and encloses the mechanism and contacts. Switch handle automatically moves to off position on overload. Wheel-type movable contact is said to clean as it rolls against the stationary contacts, and to recede into the base. Control Div., General Electric Co., Schenectady 5.

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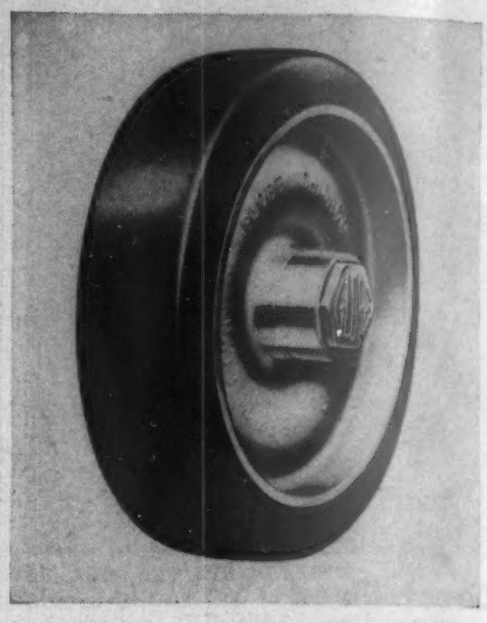

Aluminum Truck Wheel

Duo-thrust disk truck wheel, cast of aluminum alloy, features a radial angular roller bearing which is said to combine both radial and thrust loading functions. The inner race of the cartridge-type bearing is held stationary on the axle. Bearings and wheels may be interchanged from inside to outside position to equalize wear. Bearing assembly is said to be watertight; molded-on neoprene tires are impervious to oil, acids, fats, and salt. Water-repellent lubricant, called Lubriplate, is sealed in with rawhide retainers on the ground surface of the bearing shell; the waterproof, screwed-on hub cap further protects the bearing against grit and moisture from without. Wheels are standard as to axle dimension and wheel diameter. The Globe Co., 4000 South Princeton Ave., Chicago 9.

•

Emergency-Service Solenoid Valve

Intended for emergency service in which the valve is normally open, 150-lb. globe-type solenoid valve, Series No. 6000, is capable of remaining closed for indefinite periods of time, maker says. When an emergency arises, the control element causes the solenoid to be energized, closing the valve. Since the valve closes with the pressure and flow, it will remain closed as long as a pressure above 3 pounds exists on the inlet side, regardless of whether or not the solenoid continues to be energized, but can readily be opened when desired. Valve has a heavy cast body, suitable for pressures up to 150 pounds. Furnished with Jenkins disk construction to handle

It's NEW - It's Sensational

The SMALLEST "O" or "1" Size Magnetic Made

ONLY 6 3/16″ x 6 11/16″ in size of enclosure — *half the size* of vertically-operated magnetics — this Type "RA" Starter is new throughout. Sturdy, dependable, *incomparably compact.*

The *new principle* design with balanced mechanism provides a free-floating magnet with guided contact alignment. Lever and fulcrum action multiplies the leverage, transfers magnet pull from vertical to horizontal plane and increases contact pressure.

Designed for straight-through wiring, with separate contact enclosures. Embodies all the high-efficiency features found hitherto in the Size 3 and Size 2 "RA" Starters.

ARROW AH HART

This New *Size "0"* or *"1"*, Type "RA" provides local control for motors rated 5 H. P., 220 Volts and 7½ H. P., 440 or 550 Volts. Write at once for descriptive folder on this foremost advance in space-saving motor controls.

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD 6, CONN., U.S.A.

New Condenser Cuts Refrigeration Costs Saves Cooling Water

● The Niagara Aeropass Condenser cuts the cost of refrigeration by running compressors at lower head pressure, saving up to 35% of power. It uses no cooling water.

The refrigerant gas passes thru two coils in an air stream. The first, "Duo-Pass" dry coil, removes the super heat by air cooling and condenses oil vapor. The second, condensing coil, drenched by recirculated water spray, condenses by evaporation, transferring to the air 1,000 BTU for every pound of water evaporated. This done at low temperature, no scale forms on condenser tubes to clog air passage.

Between the two coils is the "Oilout", which purges the system of crankcase oil and dirt, keeps it always at full capacity.

The "Balanced Wet Bulb" control holds head pressure at the practical minimum. It automatically proportions the fresh air stream to the condensing load with the full benefit of power-saving on cool days, providing full capacity for peak loads.

Niagara Aeropass design results from over fifteen years' experience condensing by air. It is completely trustworthy for year 'round operation. Users say, "It saves half the difficulties and labor of running a refrigeration plant."

Units range from 10 to 100 tons capacity. For full information ask for Bulletin 103.

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. F, 405 Lexington Ave. New York 17, N. Y.

District Engineers in Principal Cities

INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

steam, hot or cold water, gas, air, gasoline, or oil. Available in six sizes from ¾ to 2¼ inches. Johnson Corp., Three Rivers, Mich.

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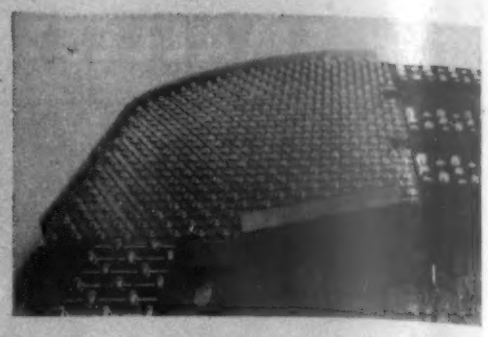

Ball-Type Transfer Table

All types of packages and cartons with flat bottoms can be handled on ball transfer table, according to the manufacturer. Suitable for installations where several conveyors or lines converge, unit is designed to take loads up to 10,000 pounds. Standard units made with transfer bales on 2-, 3-, 4-, 5-, and 6-in. centers, 12, 18, or 24 inches wide. Also built to individual requirements. Sage Equipment Co., 30 Essex St., Buffalo 13.

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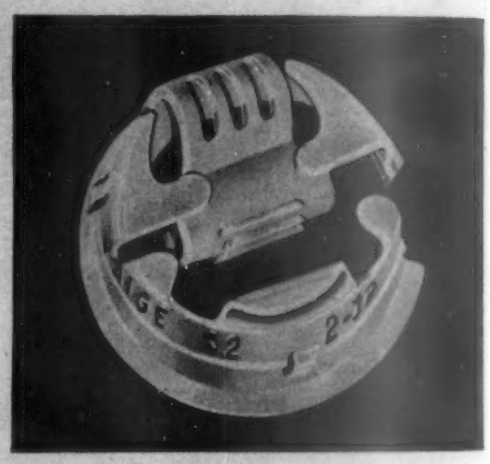


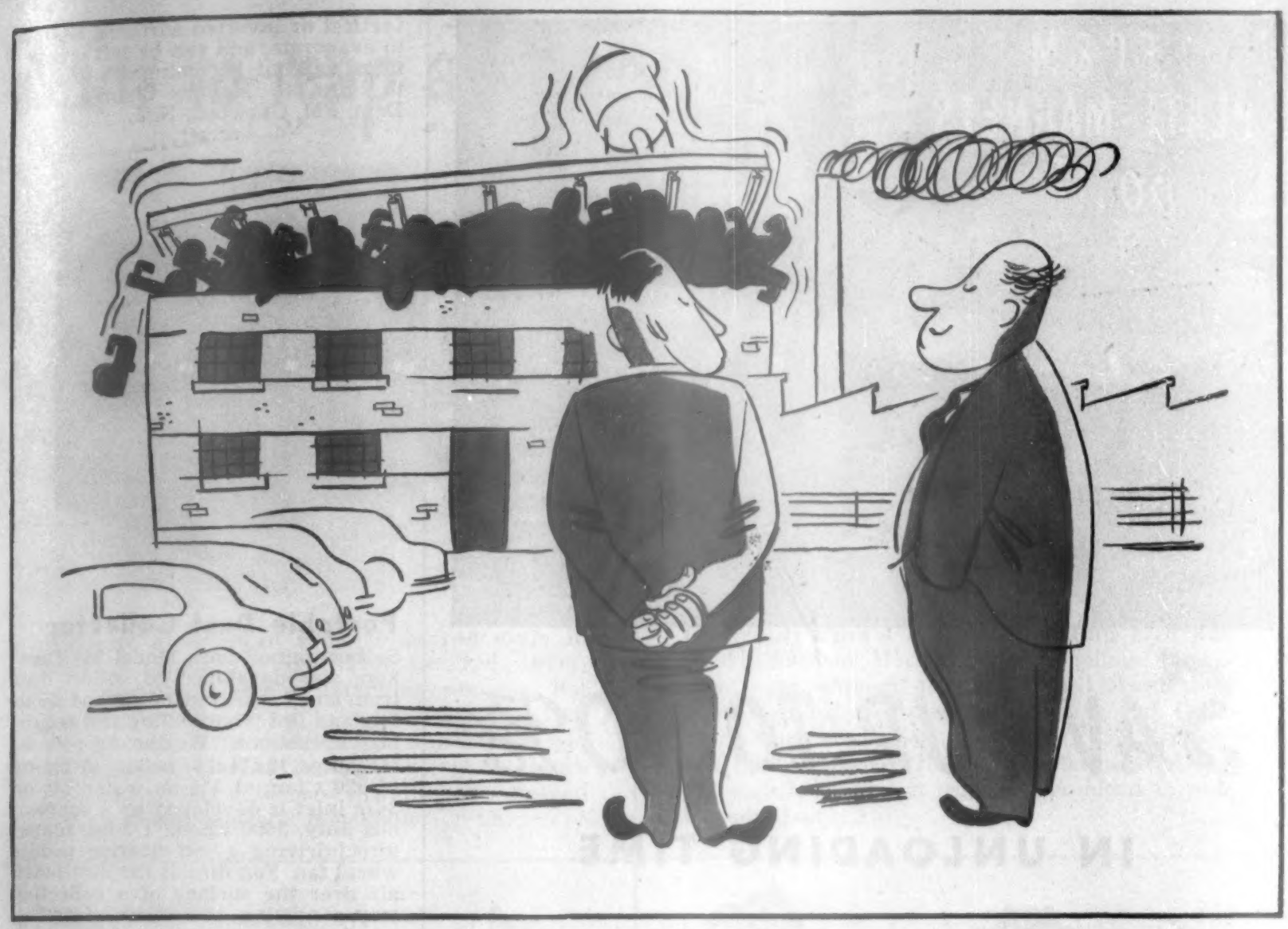
Non-Metallic Cable Connector

Designated Paige No. 52, non-metallic sheathed cable connector for electric outlet boxes is made of spring steel and plated against corrosion. Installed by pressing with thumb or tapping lightly from inside of the knockout until the connector snaps into position against the outlet box. Required length of cable is pushed through the connector, where connector holds it in position without screws or locknuts. Complete assembly operation is said to require only 7 seconds. Allied Electrical Mfg. Corp., 1 North LaSalle St., Chicago 2.

•

Paint Remover

For removing paint or baked finishes, material called Stripit is said to remove three coats in one application. Manufacturer states that the first coat begins to pucker in 1 to 5 minutes, and that a cutting stream of water directed on the surface will remove all the loosened paint in a few minutes. The material is nonflammable, and said to be safe to use on any metal or wood, and will not bleach or raise the grain of wood. It is heavy-bodied, and clings to



"Didn't I tell you Reeves Speed Control would raise our production ceiling?"

● REEVES-equipped machines turn out more work and do more different jobs—more accurately and economically—because instant, infinitely variable REEVES Speed Control provides the right speed for every operation and every operator, under every changing condition. Specify REEVES Variable Speed Drives for your new machines—apply them to machines now in service. Let an experienced REEVES Speed Control engineer assist you in choosing the proper units for your operation from the complete REEVES line, including a wide range of designs, sizes and speed ratios—with manual, push-button or automatic control. Write for the 114-page catalog, No. F2-450A.

THE 3 BASIC REEVES UNITS

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.

VARI-SPEED MOTOR PULLEY provides an instantly variable speed drive within 4:1 ratio for any constant speed motor. Sizes to 15 hp.

MOTODRIVE combines motor, speed varying mechanism and reduction gears in single unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 20 hp.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

ACCURATE • VARIABLE

Reeves Speed Control

GIVES THE RIGHT SPEED FOR EVERY JOB!

EC&M
PLATE-MAGNETS
DO IT
FASTER
20 tons unloaded by *magnet* in 15 to 20 minutes. Estimated time by *chain-slings*, 3 to 4 hours. Magnet does the job in about 1/10 the time.

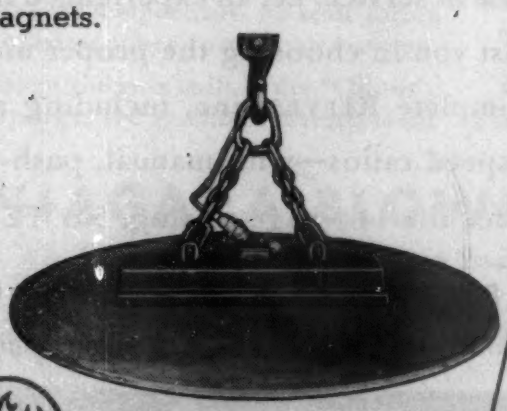
SAVE UP TO 90%

IN UNLOADING TIME

Here's a plant that uses several EC&M Plate-Magnets in the loading, unloading, stacking and processing of their plates, sheets, bars, pipe, etc. On long pieces, they use two magnets on a spreader-bar.

These EC&M Magnets not only reduce operating costs but they speed up handling. Railroad cars or trucks are loaded or unloaded without delay and handling throughout the plant is fast. There's no prying to affix chains and no danger of pinching hands when securing chains.

Send us the complete facts of your handling needs, so that we may write fully when sending Bulletin 903 describing EC&M Plate-Magnets.



Burned Plates, too, pull out easily when lifted by Magnet.

TELL ALL FOR PROMPT RECOMMENDATION

Give an idea of your plant layout and equipment, and material handled, such as

1 - Style and capacity of crane.
2 - Voltage available (direct current is required for magnets).
3 - Overall dimensions and weight of material handled.

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO

vertical or inverted surfaces, is slow to evaporate, and can be left on surfaces without becoming set or hard to rinse off. Magnus Chemical Co., Dept. FM, Garwood, N. J.

•

Portable Dust Collector

Self-contained unit, Model 335 Dustkop, was developed to collect dust from small wheel grinding and sanding, and lint from buffing and polishing, operations. Weighs 43 pounds. Measures 12x14x18 inches. A rating of 320 c.f.m. at 1½-in. water lift on 3-in. inlet is developed by a continuous duty, 3600 r.p.m., 1/3-hp. motor, direct-driving a self-clearing paddle wheel fan. Fan directs the dust-laden air over the surface of a collecting tray consisting of a series of baffles, which remove the lint, chips, wire, and heavier dusts. A spun-glass filter forms the top of the collector, and provides a second-stage cleaning of the air before it is returned to the working space. Hand crank mounted on the side of the cabinet serves to shake down the filter into a removable dust tray. Aget-Detroit Co., Main at Washington Sts., Ann Arbor, Mich.

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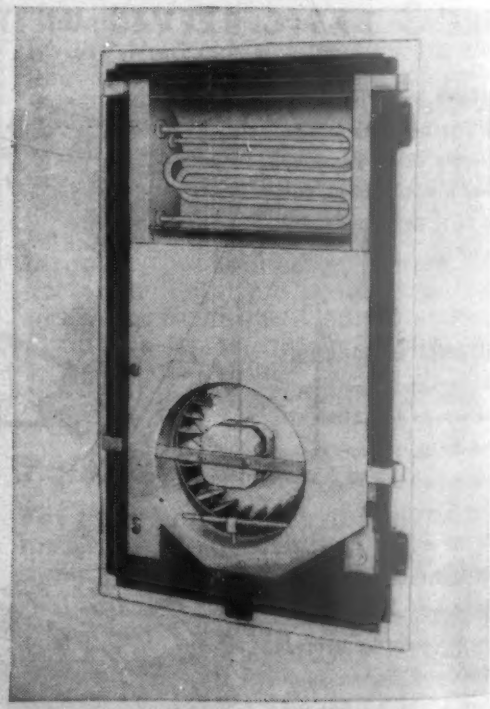
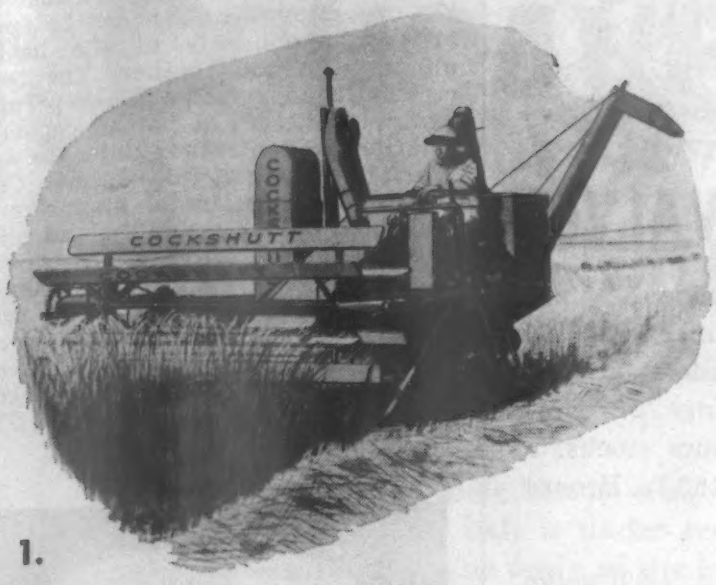


Recessed Wall Heater

Equipped with built-in thermostat, pressure-type fan, ball-bearing motor, and electric tubular heating

Want to reap a harvest in your business?

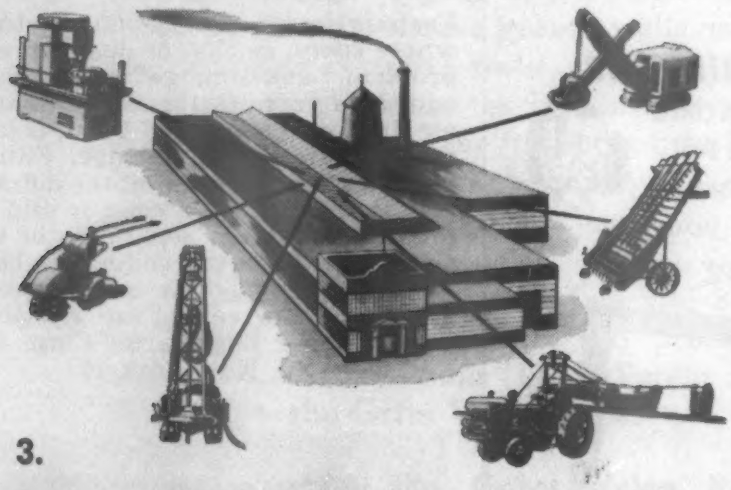


1.

Wanted: a one-man crew to harvest grain in labor-short areas. Cockshutt Plow Co., Ltd., Brantford, Ont., built such a harvesting combine. But trouble-free operation had to be assured on such vital turning parts as the shaft between transmission and differential. Needed: a flexible coupling to absorb shock and vibration, increase shaft life, yet withstand grit, chaff and moisture. Impossible?...

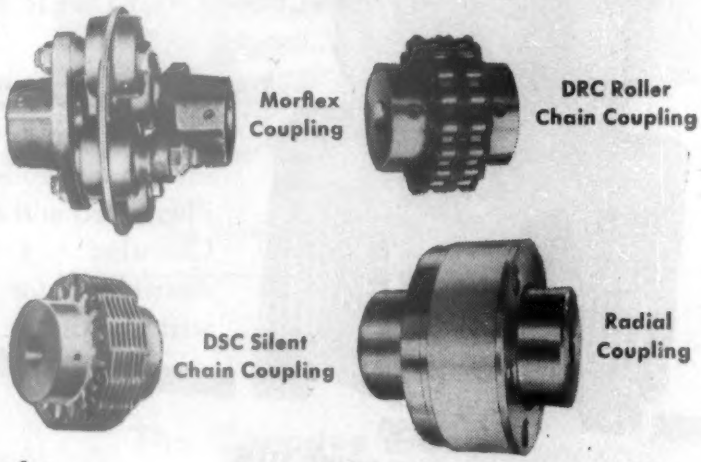
2.

Cockshutt Plow's unusual coupling need was quickly filled by Morse Morflex Couplings. Shockproof, quiet, compact—they take all the kicks the combine gives, *and compensate for misalignment.* Other Morse Couplings—Silent and Roller Chain, 'Junior' and Double Morflex, Radial and Marine Morflex—are made to thresh out particular problems in *your* business. Just . . .



3.

Look how Morse couplings have been applied to such diversified uses as machine tools, material handling lifts, oil wells, power shovels and conveyors. In your plant or on your consumer product, *Morse couplings speed production, eliminate bearing wear, protect equipment and workers.* For that extra attractive addition that makes your consumer products sell, investigate Morse Couplings, right now. Perhaps . . .



4.

You'll get plenty of bright ideas for coupling uses from a set of Morse coupling catalogs. Address: Dept. 242, Morse Chain Co., 7601 Central Ave., Detroit 8, Mich. Or, for on-the-spot engineering advice and aid, write or wire—trained and experienced Morse Sales Engineers will call on you. Ask to see and hear more about the entire line of Morse Mechanical Power Transmission products.

Roller Chain Drives

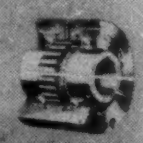
Morse-Rockford Friction Clutches

Silent Chain Drives

MORSE

MECHANICAL POWER TRANSMISSION PRODUCTS

A PRODUCT OF B-W BORG-WARNER



Morse-Formsprag Over-Running Clutches

MORSE CHAIN COMPANY • DETROIT 8, MICHIGAN

"LIKE HAVING THREE VALVES IN ONE"

LUNKENHEIMER

150 lb. S.P. BRONZE GATE VALVES

Fig. 2150
DOUBLE WEDGE DISC, RISING STEM

THE enthusiasm of maintenance men *and* engineers for the Lunkenheimer new 150 lb. Bronze Gate Valves is understandable. Actually, a simple interchange of trimmings provides, from minimum stocks, a valve for every spot where a 150 lb. Bronze Gate Valve is needed.

Ruggedly designed throughout, each valve features the Lunkenheimer developed and patented wear-resistant alloy stem material which eliminates failures due to stem thread wear.

Whether you have one . . . or thousands of 150 lb. bronze gate valves in your plant, you'll find definite advantages in the LUNKENHEIMER Fig. 2150 line of 150 lb. gate valves.

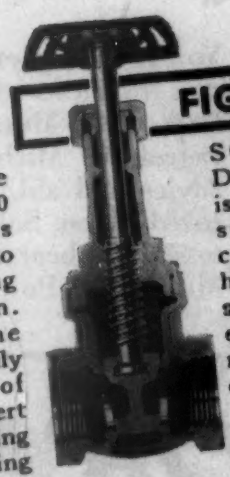
PHONE YOUR DISTRIBUTOR

Design, construction and interchangeability are fully illustrated and described in Circular 574. Ask your distributor for a copy or write us direct.

FIG. 2153

Embodies all the features in Figs. 2150 and 2151, but its design is varied to provide non-rising stem operation. Body is the same thus requiring only an interchange of trimmings to convert from the non-rising stem to the rising stem valve.

FIG. 2151



SOLID WEDGE DISC. The solid disc is ideal for services such as food processing lines and handling gummy substances, where entrapment of line materials within the disc is undesirable.

See Our Exhibit at the 18th National Exposition of Power and Mechanical Engineering. Booth #52, Grand Central Palace, N. Y. Nov. 29th-Dec. 4th.

ESTABLISHED 1862
THE LUNKENHEIMER CO.
"QUALITY"
CINCINNATI 14, OHIO, U. S. A.
NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 24
EXPORT DEPT 318-322 HUDSON ST., NEW YORK 13, N.Y.

units, recessed wall heater is suitable for use where one or more individual heaters are preferable to a central heating system or where extra heat is found necessary. Available in 2, 3, 4, and 5 kw. for 236-volt a.c. operation. The fan can be operated independently of the heater elements in hot weather. The 3-circuit multiple snapswitch also permits heater operation at partial capacity. Thermostat control regulates the unit when operating at full capacity. Consists of 3 parts; metal mounting or wall box, heater assembly, and grille cover. Thermal cutout prevents overheating of the elements in case of accidental fan stoppage, and a reset button restores current when fan operation is resumed. Only wiring needed is a 236-volt, two-wire connection. Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8.

•

Ceiling Smudge Eliminator

For use in air conditioning systems where sooty, smoky, or dusty air is a problem, anti-smudge cone, when added to manufacturer's adjustable air diffuser, called Kno-Draft, is said to eliminate ceiling smudge. Fitting between the outer rim of the diffuser and the ceiling, the cone is said to provide minimum separation of the air stream from the ceiling. Rubber gaskets for the joints between cone and diffuser or ceiling are available. W. B. Connor Engineering Corp., 114 East 32nd St., New York 16.

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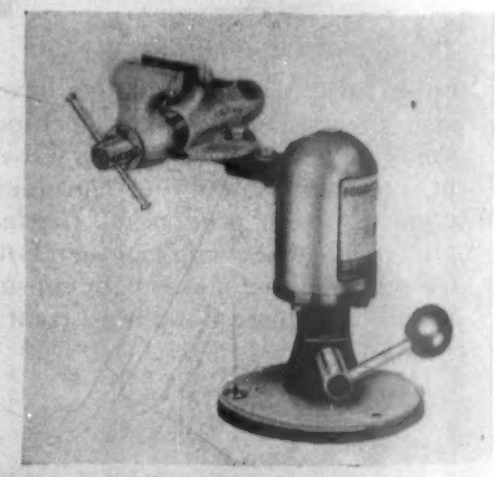


Work Holder

Mechanically operated for light work, or hydraulically for heavy, ball-and-socket positioner, called Powrarm, locks work at any angle on 350-deg. horizontal or axial plane, or on a 180-deg. vertical plane, according to manufacturer. Holds work up to 150 pounds. Both models can be bolted to workbench. Clamp available for attaching in other locations.

Here is **WHY** the

CONCAVE SIDE-

(U. S. PATENT NO. 1813698)

SAVES You Many DOLLARS In V-BELT Costs!

Every time a V-Belt bends around its pulley, the *top* of the belt is under *tension* and grows *narrower.* The *body* of the belt is *compressed*—causing the *sides* to *bulge out!*

FIG. 1

Because of these stresses, any V-Belt built with straight sides is forced to assume, in the sheave groove, the shape shown in figure 1, on the left.

This forced bulging of a *straight-sided* V-Belt against the sheave groove walls naturally produces excessive wear along the *middle* of the belt's sides—as indicated by the arrows. Also, because the full side of the belt does not *uniformly* grip the pulley, there is a definite loss in drive efficiency.

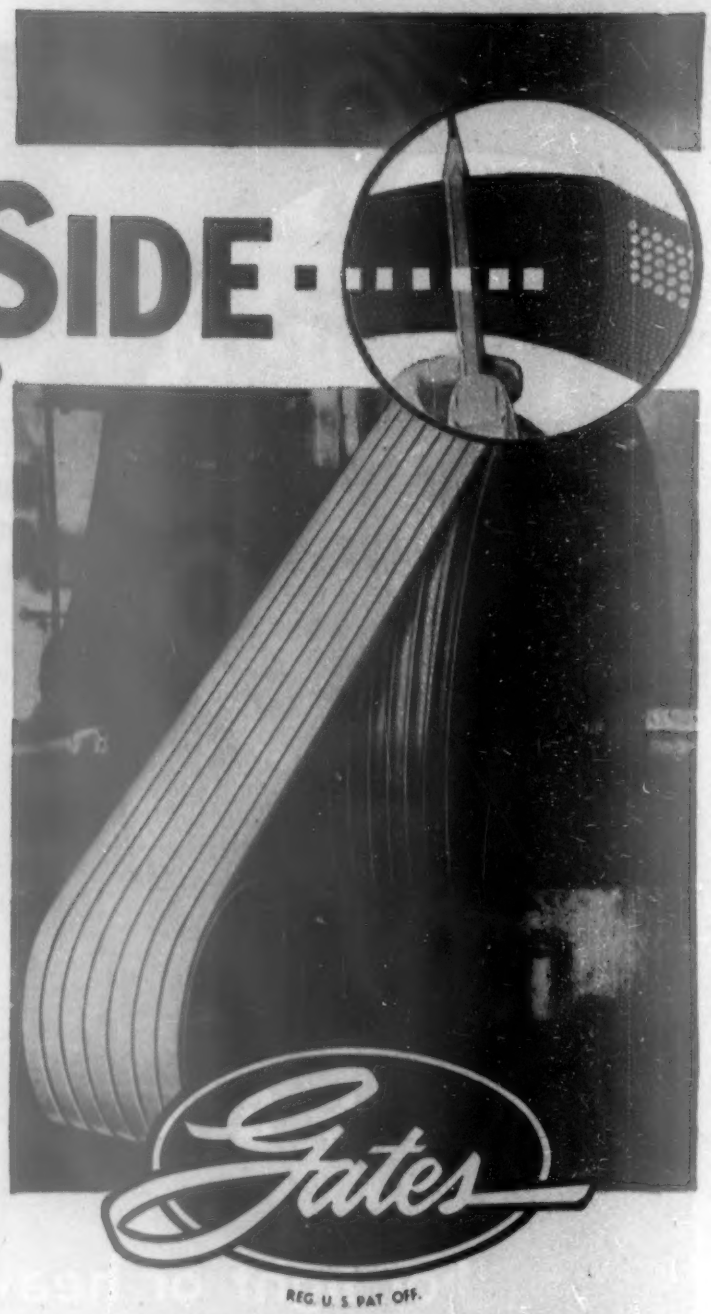
Now see the difference when you bend the V-Belt that is built with the precisely engineered Concave Side (U. S. Patent No. 1813698)—the Gates Vulco Rope.

FIG. 2

As the Gates Vulco Rope bends, its Concave Side becomes straight (Figure 2). It exactly fits the sheave groove—and this gives you two very definite savings:—

(1) No out-bulge of the sides means uniform side-wall wear—*longer life!*

(2) *Full side-width* grip on the pulley carries heavier loads and sudden load increases without slippage—saving your belts and saving power too!



REG. U. S. PAT. OFF.

The Mark of SPECIALIZED Research

The Concave Side is MORE IMPORTANT NOW Than Ever Before!

Because the *sides* of a V-Belt are what actually *drive* the pulley, it is clear that any increased load on the belt means a heavier load that must be transmitted to the pulley *directly* through the belt's sidewalls.

Now that Gates SPECIALIZED Research has made available to you *SUPER* Vulco Ropes—carrying fully 40% higher horsepower ratings—the life-prolonging Concave Side naturally delivers greater savings today than ever before.

4810

GATES VULCO ROPE DRIVES

Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries

THE GATES RUBBER COMPANY
DENVER, U.S.A.
"The World's Largest Makers of V-Belts"

DARNELL
CASTERS & WHEELS

For light or heavy duty service Darnell Casters and Wheels are made for a long life of trouble-free usage, to protect floors and increase employee efficiency.

DARNELL CORP. LTD
LONG BEACH 4, CALIFORNIA

60 WALKER ST., NEW YORK 13, N.Y.
36 N. CLINTON, CHICAGO 6, ILL.

and various attachments are made for use on specialized work. Wilton Tool Mfg. Co., 936 Wrightwood Ave., Chicago 14.

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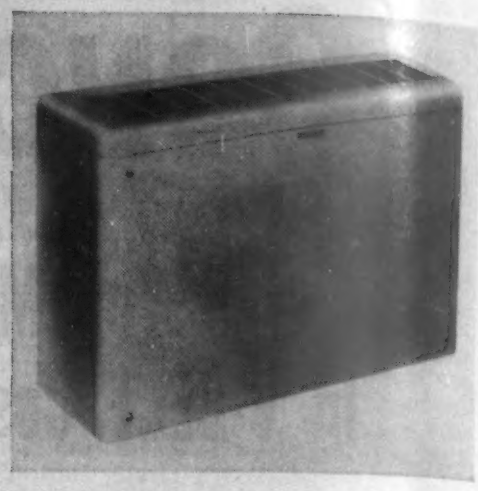

Cabinet Heaters

Cabinet unit heaters, built to deliver high capacity heat output without excessive blast, are equipped with a silent-operating removable blower assembly and resiliently mounted motor. May be used with either steam or hot water systems. Three different models are available, with three sizes in each style. Style A, basic unit, can be shipped from stock; Style B, universal unit, and C, a semi-recessed unit, are made to order. The heaters are available in a number of arrangements, and, with accessories, may be wall hung, inserted wall hung, ceiling mounted, with ducts, with inlet grilles, and in other types of installation. Knockouts are located in the ends of the cabinets to permit connections to be made directly through the sides, providing proper drainage whether vertically or horizontally mounted. Coil can be pitched in either direction. Young Radiator Co., Racine, Wis.

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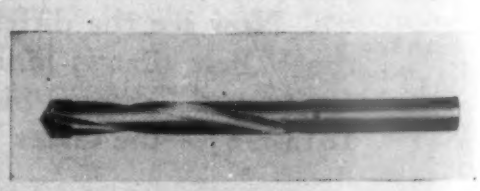


Masonry Drill

Designed for use on brick, concrete, stone, and similar materials, carbide-tipped masonry drill may be used in all types of continuous drilling, but is said to be especially effective in medium and deep hole work. Spiral flutes carry the chips or powdered material up out of the hole, permitting free cutting without drill seizure, and reducing shank bending and drill breakage, says manufacturer. Super Tool Co., 21650 Hoover Rd., Detroit 13.

•

Electrical Outlet Stripping

Providing electrical outlets at either 6- or 18-in. intervals, raceway, called Plug-In Strip, allows a series of machines or lamps to be plugged into the circuit without extension cords, thus reducing fire hazards. The 24-gage steel channel and the two No. 12 copper wire conductors inside the raceway may be cut to fit at any spot

6 INSIDE REASONS for Choosing..

the

RELIANCE GEARMOTOR

1 Helical, wear-hardened gears cut from alloy steel forgings and shaved before hardening for correct eccentricity and helical angle and bright, smooth surfaces—factors contributing to quiet operation and longer life.

2 Gear arrangement in simple train minimizes number of moving parts—promotes quietness.

3 Pinion and gear supported and spaced to reduce deflection—permits high load-carrying capacity.

4 Splash system with large oil reservoir assures constant and thorough lubrication of all parts.

5 Anti-friction bearing construction throughout.

6 Reliance *Precision-Built* Motors provide the maximum in dependable and economical power. Types that may be had with GearMotoR are described in GearMotoR Bulletin C-404. Ask also for bulletins describing Reliance *Precision-Built* A-c. Motors—engineered for every power requirement.

Sales Representatives in Principal Cities

RELIANCE ELECTRIC AND ENGINEERING CO.

1070 IVANHOE ROAD • CLEVELAND 10, OHIO

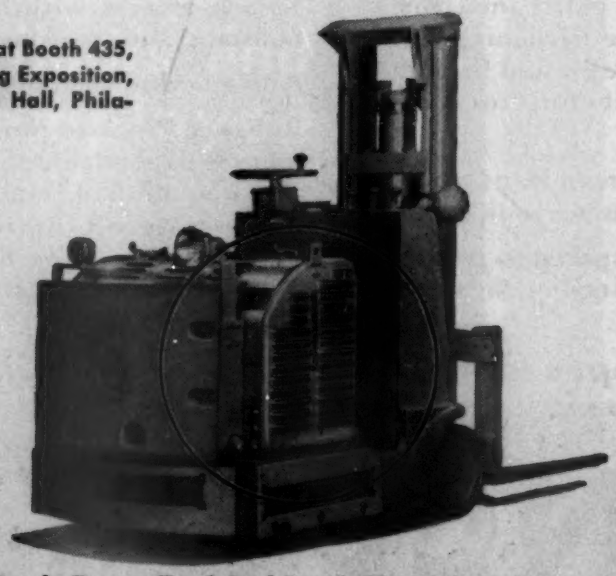
"Motor-Drive is More Than Power"

Let READY-POWER Solve Your Trucking Problems

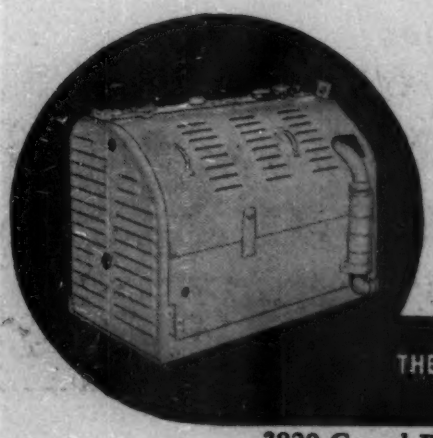
Ready-Power-Equipped Baker Fork Trucks Loading Semi-Trailers

Heavy loads and long hours can't stump Ready-Power gas-electric Power Units. They are designed to "take it" and built to last. They're better than good enough to handle the toughest jobs hour after hour, day after day with constant power generated right on the truck. Specify Ready-Power for your next electric truck or write for information about converting present equipment.

Visit the Ready-Power Display at Booth 435, 3rd National Materials Handling Exposition, January 10 to 14, Convention Hall, Philadelphia, Pa.



Ready-Power-Equipped Lewis-Shepard Fork Truck



THE READY-POWER CO.

3820 Grand River Ave., Detroit 8, Michigan

between receptacles, with a copper connector crimped over the wire ends to eliminate soldered and screwed connections. Ten matching fittings include interior, exterior, and flat elbows, center and end feeds, and fill-in strips for inaccessible places. National Electric Products Corp., Chamber of Commerce Bldg., Pittsburgh 19.

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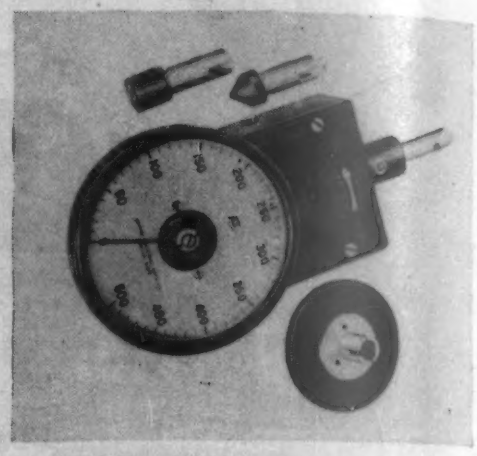


Hand Tachometer

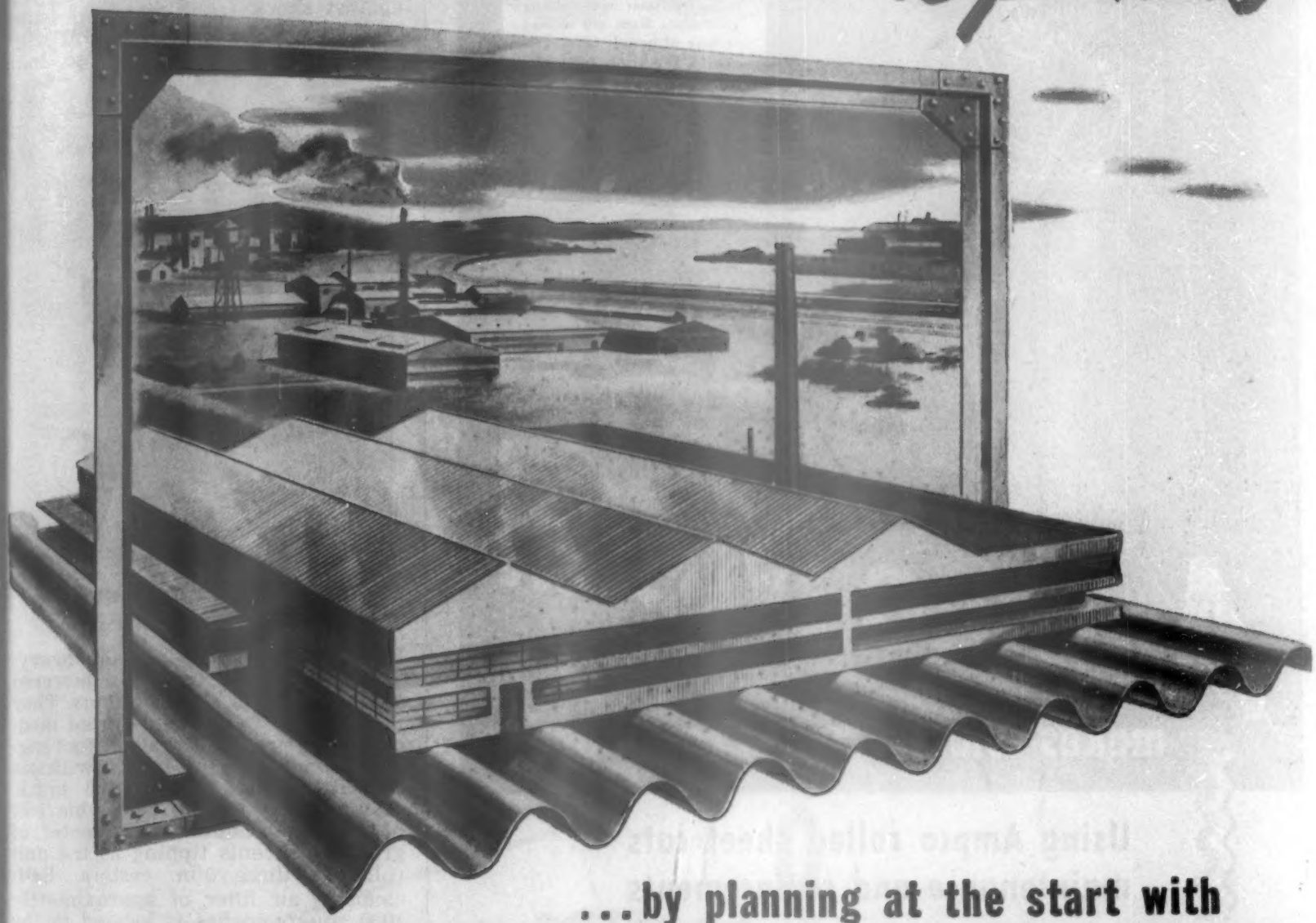
Instrument pointer on hand tachometer always reads in the same direction irrespective of the direction of the rotation of the instrument spindle. Transmission of the driving spindle rotation to the pointer is effected mechanically in the first stage and magnetically in the second. Pushbutton enables operator to hold the pointer steady at indicated reading for examination. By pressing the button on the opposite side of the instrument, pointer returns to zero. Claimed to read within plus or minus 0.5 per cent. Made in three models, each model with three ranges and built-in ambient temperature compensating device. Model ATH4 has maximum range of 0 to 50,000 r.p.m. or 0 to 25,000 f.p.m. Equipoise Controls, Inc., Distributor, 100 Stevens Ave., Mt. Vernon, N. Y.

•

Sectional Pole for Lamp Changer

Lightweight steel pole, furnished in 5½-ft. interchangeable sections, is

You save on the frame *and on the whole picture*



...by planning at the start with

REYNOLDS *Lifetime* ALUMINUM INDUSTRIAL CORRUGATED

FIREPROOF, rustproof, needing no painting, Reynolds Industrial Corrugated is superior for any structure, new or old. Year-after-year maintenance savings make it a first choice of plant superintendents. But you get its full advantages when you plan buildings expressly for it.

Its light weight, combined with ample strength, permits economies in framing structure which should be incorporated in your original plans.

The fact that aluminum reflects up to 95% of radiant heat —materially reducing summer temperatures, helping to retain winter warmth—should be considered in your heating and ventilating plans.

The inside aluminum surface has high light reflectivity. Your illumination can be planned for better visibility at lower cost.

Our technicians will be glad to assist you in your planning, and to coordinate deliveries with your construction schedule. For full information write for literature.

REYNOLDS METALS COMPANY
Building Products Division, Louisville 1, Ky.
OFFICES IN 32 PRINCIPAL CITIES

WORLD'S LARGEST PRODUCER OF ALUMINUM BUILDING PRODUCTS:

Shingles, Clapboard Siding, Corrugated and 5-V Crimp, Snap-Seal and Standing Seam Roofing, Weatherboard Siding, Built-Up Roofing, Nails, Gutters, Wall Tile, Casement and Picture Windows, Reflective Insulation, the "Alumi-Drome" (prefabricated utility bldg.).

IF YOU SEE RUST YOU KNOW IT'S NOT ALUMINUM

REYNOLDS *Lifetime* ALUMINUM BUILDING PRODUCTS

Tumbling barrels completely fabricated by Ampco Metal, Inc. of Ampco-8 sheet, welded with Ampco-Trode corrosion-resistant arc welding electrodes. Studs are welded to base of barrels for mounting on tumbling turntable.
Ampco Metal
makes tumbler-barrel costs tumble

Using Ampco rolled sheet cuts maintenance and replacements

Tumbling barrels are used to clean rivets, screws, nuts, and a variety of similar small parts. Formerly, they wore out quickly—because of the cleaning solution's corrosive action, and the abrasive effect of swirling metal parts. Replacement costs were high, until the manufacturers switched to tumbling barrels fabricated with Ampco-8 sheet. This durable, corrosion-resistant alloy solved their expensive replacement problem in jig-time.

That is just one more case of the money-saving value of Ampco Metal's unique physical properties. Hundreds of companies use durable Ampco Metal and Ampcoloys in their own products as selling features—and in their production equipment as insurance against heavy maintenance and replacement costs on parts subject to wear.

Call in your nearby Ampco engineer for cost-cutting suggestions. Write for complete information on Ampco castings, extrusions, forgings, sheet, and fabricating service.

Ampco Metal, Inc.
Department FA-11 • Milwaukee 4, Wisconsin
Field offices in principal cities

so designed that sections may be joined together to provide a pole up to 30 feet long for replacement or removal of light bulbs. Spring-actuated button locks the sections together, and permits quick disassembly. Each section is insulated for protection against shock from contact of pole or head with live wires. McGill Mfg. Co., Inc., Dept. LC, Valparaiso, Ind.

•

Heavy-Duty Vacuum Cleaners

Built in four sizes, Tornado heavy-duty vacuum cleaners are powered by 2-, 3-, 5-, and 7½-hp. motors. They may be had in explosion-proof models, and have static water lifts ranging from 60 to 105 inches with air velocities from 315 to 480 m.p.h. moving from 200 to 360 cubic feet of air per minute. Low center of gravity prevents tipping as the unit rolls on three 8-in. casters. Self-cleaning air filter of approximately 1000 square inches is located in the vacuum head and may be operated by the vacuum blowing lever even when it is running. Movement of this lever changes unit from suction to blowing. Unit picks up both wet and dry substances simultaneously without harm to the filter or tank, and without special attachments. Equipped with two intakes, either or both of which can be used with 1½- or 2-in. hose and attachments operating simultaneously. Breuer Electric Mfg. Co., 5100 Ravenswood Ave., Chicago 40.

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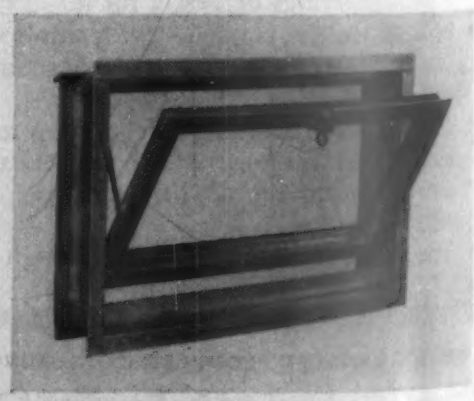


Steel Frame for Glass Block

Stainless steel ventilating window frame, for use with glass block, requires no painting, uses no rubber

DELCO MOTORS

DON'T ASK FOR TIME OUT

To avoid costly down-time . . . to be sure of a smooth flow of power hour after hour, day after day, even under the most unfavorable operating conditions . . . call on Delco for your industrial motor equipment.

You can always count on a reliable Delco motor to carry its load—and you need not count on down-time.

Special features of design account for the outstanding reliability, efficiency, and low maintenance costs of these Delcos. Among these features are locked bearings, Delcote insulation for the coils, corrosive-resistant cast-iron frame, positive lubrication, dynamically balanced rotor and shaft assembly, watertight four-position conduit box.

Delco totally enclosed fan-cooled motors are produced in sizes ranging from fractional ratings to 75 h.p. (Continuous duty, constant speed, 60 cycle, polyphase.)

For complete data on Delco Motors, address Delco Products, Dayton, Ohio, or our nearest sales office.

DELCO PRODUCTS DAYTON, OHIO

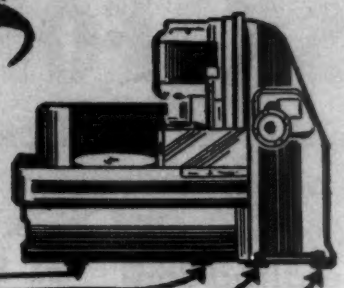
DELCO MOTORS

DELCO PRODUCTS, DIVISION OF GENERAL MOTORS CORPORATION

SALES OFFICES: CHICAGO • CINCINNATI • CLEVELAND • DETROIT • HARTFORD

REDUCE MACHINE MAINTENANCE SAVE YOUR FLOORS

THIS EASY WAY!



ISOMODE* vibration-absorbing PADS

√ Work under present machine feet or base
√ Eliminate special foundations, drilling, bolting in most cases
√ Speed installation or relocation of equipment
√ Protect precision of work and also reduce noise

Why put up any longer with the expense, with the wear and tear caused by vibration and impact? You can now avoid them in *your* plant merely by placing cushioning Isomode Pads between machines and floor. It's effective, quick, surprisingly *economical!*

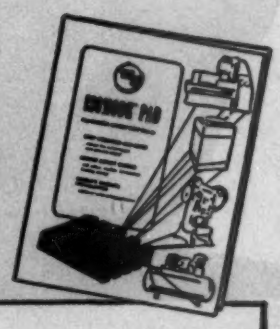
And once you have Isomode Pads installed, the savings mount up. You not only reduce machine maintenance, but also guard against undue fatigue and impaired efficiency of workers. You save the cost of special, expensive foundations for impact machinery.

You may wonder how, with a pad only 5/16-inch thick, it can cushion the pounding of heavy machines. Yet with the extra resiliency obtained through the "cross-cleated" construction, and when properly loaded 50 pounds to the square inch, MB Pads display remarkable absorption of vibration and shock. As much as 78% of the vibration transmitted to the floor by one leg of a loom, for example, was stopped by Isomode Pads. Their proved performance in *thousands of installations* attest to the fact that they will do their job for years—resisting oil, water, aging.

Isomode Pads are supplied in various standard sizes which can be cut right on the job to conform to the machine.

*Trade Mark Reg. U. S. Pat. Off.

SEND FOR THIS DETAILED BULLETIN
It tells you about more money-saving benefits—shows how simple it is to install the pads properly.



THE MB MANUFACTURING COMPANY, INC.
1080 State Street, New Haven 11, Conn.

or felt gaskets. Sash is of rigid tubular construction. Can be furnished with plastic screens having a stainless steel frame. Standard sizes are carried in stock, and the windows can be furnished to specification. Modern Electric Laboratory, 6131 South Wentworth Ave., Chicago 21.

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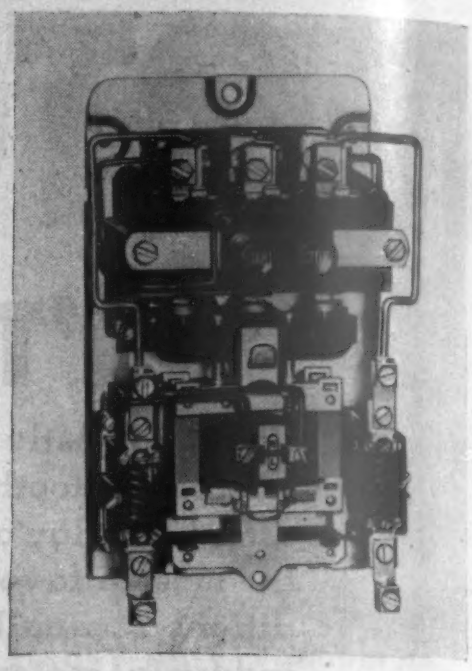

Magnetic Motor Starter

Solenoid-operated starter is intended for applications where across-the-line, non-reversing starting of polyphase squirrel-cage induction motors and single-phase motors is required. Available with open type construction for built-in or specialized controls or with NEMA Type I general purpose enclosures. Starters can be controlled by separate pilot devices or supplied with local control pushbuttons or selector switches. Other features include high-arc interruption capacity, thermal overload protection, built-in solderless connectors, and double-break silver-to-silver main contact. Maximum enclosed rating is 25 horsepower, 440/550 volts, 3-phase, 60 cycles. Standard operating coils can be supplied for 110, 208-220, 440, and 550 volt, 25 or 50-60 cycle service. Dual voltage can be furnished for 110-220 or 220/440 volt, 60 cycle operation. Ward Leonard Electric Co., Mt. Vernon, N. Y.

•

Square Stacking Box

Of all-steel construction, square stacking box, for handling miscellaneous parts, has a four-way entrance with a corrugated bottom. It

is supported by four angle legs with shoes for floor protection. The square construction permits stacking any way. Boxes are built in any size to customer's specifications. Palmer-Shile Co., 16007 Fullerton Ave., Detroit 27.

•

Small-Parts Washer

Providing fire protection when using flammable cleaning solvents, portable parts washer, called Air-Matic, operates on any compressed air supply. The perforated basket into which parts are placed for washing moves up and down through the solvent. Reciprocating air engine eliminates hazard of spark igniting flammable vapors. Should contents become ignited accidentally, cover is designed to close automatically and snuff out the fire. The Protectoseal Co., 1920 South Western Ave., Chicago 8.

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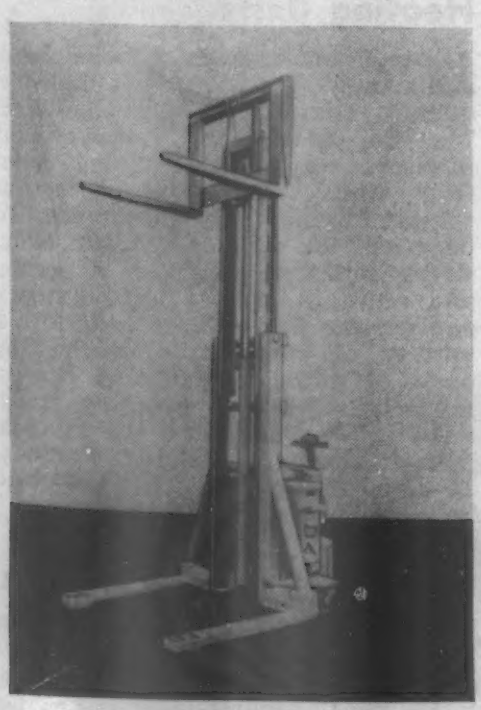


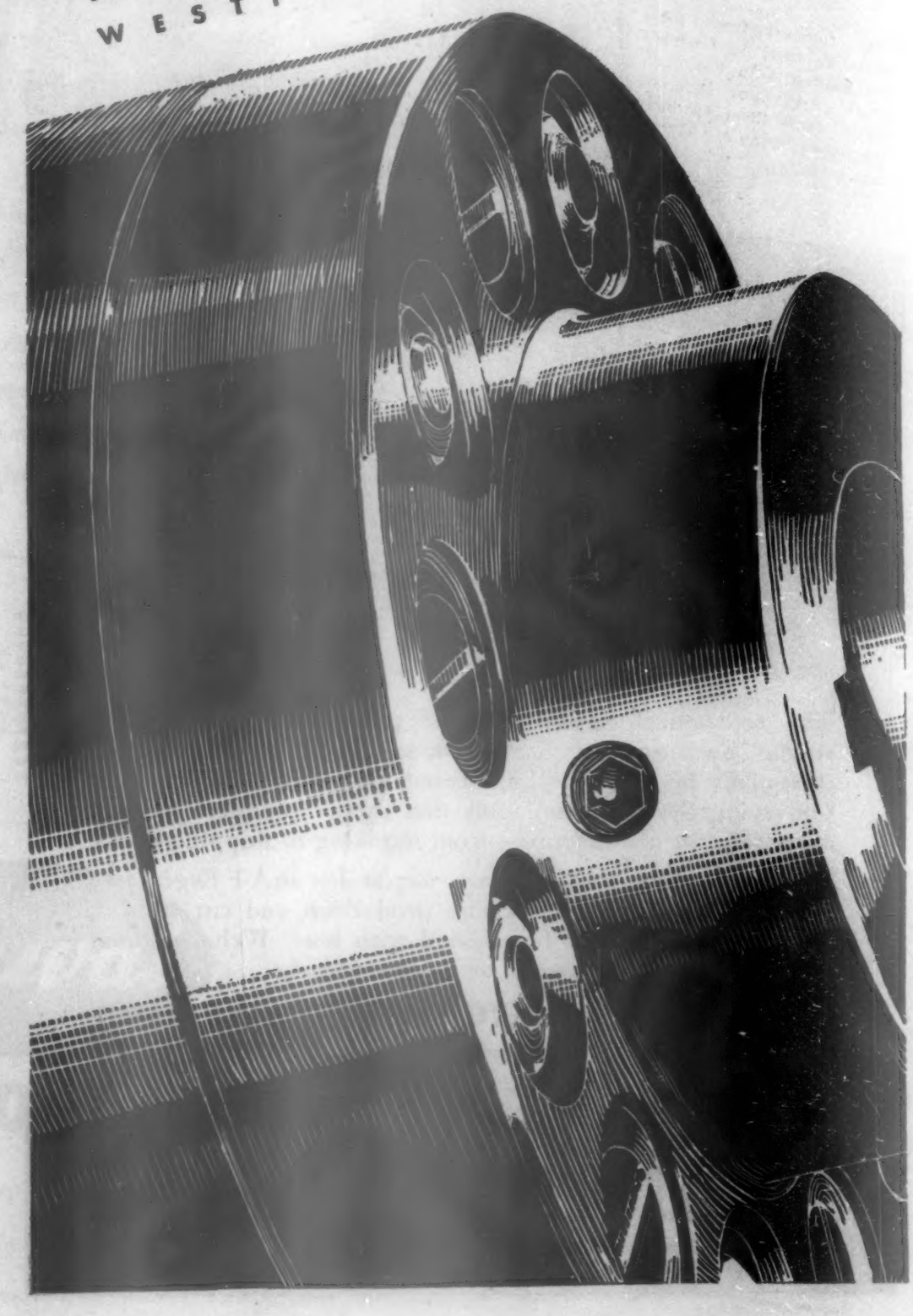
Telescopic Fork Truck

Called the Jackstacker, electrically operated telescopic fork truck, with capacities up to 4000 pounds, is designed for the movement and high

AJAX FLEXIBLE COUPLINGS

The fact that *all the horsepower* goes *through the coupling* emphasizes the *importance* of protecting direct-connected machines against misalignment. Write for the Ajax Coupling data book or phone the Ajax man in your territory.

AJAX FLEXIBLE COUPLING CO. INC.
WESTFIELD, NEW YORK

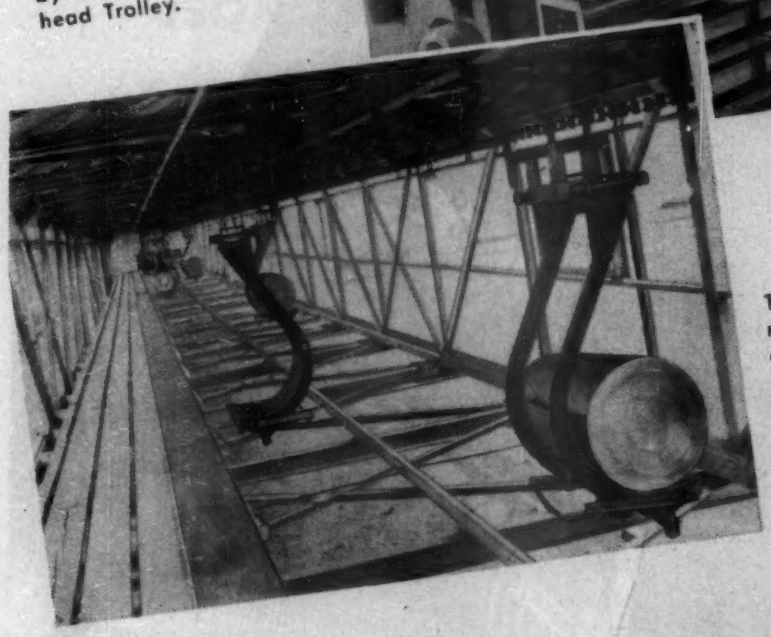


A-F
CASE FILE

PROCESSING MATERIAL GOES UP!
-Manufacturing Costs Go Down
with this production-pacing A-F Conveying System

At the plant of a leading electrical manufacturer, this unusual A-F Trolley Conveying System moves barrels of compound in a "steady stream" up to and across the plant roof to the pre-melt tanks for processing into ballast.

After removal from the track-side cars, the barrels are loaded onto the A-F Chain Conveyor feeder which starts them upward by means of the A-F Overhead Trolley.



The barrels take to the roof on the space-saving economical route to the far side of the plant, where they are automatically unloaded from the A-F Conveyor.

The economical performance of this continuous "endless-stream" operation is typical of the savings effected throughout this plant by the A-F Engineered Completely Co-ordinated Conveying System installation that carries products through every stage of manufacture—from receiving to shipping docks.

We believe we can easily prove to you that an A-F *Engineered* Conveying System will increase production and cut costs in *your* plant, too! Why be satisfied with less? Write, without obligation, for a discussion, or folder—today!

THE ALVEY-FERGUSON COMPANY

141 DISNEY ST. *Established 1901* CINCINNATI 9, OHIO

Offices or Representatives in Principal Cities—Coast to Coast

CONVEYING EQUIPMENT

A-F CONVEYING MACHINERY **Alvey-Ferguson**

METAL PRODUCTS CLEANING EQUIPMENT

stacking of materials on skid platforms, pallets, or in sectional bins. Telescopic feature allows passage through doorways, under trusses, or other overhead obstruction. Counterweighted, straddle-type, open-end base, and platform-type models are available. All controls are operated from the handle head with handle in vertical or any other position, according to the manufacturer, who states that it is not necessary to halt the truck to raise or lower the lifting carriage. Truck has 2 speeds forward and reverse. Other features include constantly applied type electric brake which may be released only by depressing handle triggers; solid, flexible connections between battery and drive unit; and changeable drive unit assembly. Lewis-Shepard Products, Inc., 274 Walnut St., Watertown 72, Mass.

•

High-Frequency Heating Units

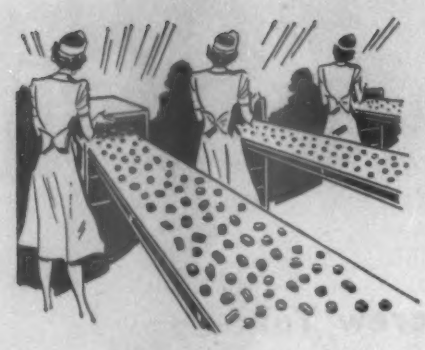
All-steel construction of frame, base, and panels is a feature of high-frequency heating units available in 7½-, 15-, and 30-kw. ratings. Unit interiors are of fire-resisting materials. Applicable for use on ferrous or non-ferrous materials, units can be used for hardening, annealing, stress relieving, brazing, soldering, and melting without any auxiliary equipment. Can also be used with a variety of work coils for heating parts of different sizes and shapes, without requiring matching transformers or condensers, according to manufacturer. Lepel High Frequency Laboratories, Inc., 39 West 60th St., New York.

•

Multiple Drop-Feed Oilers

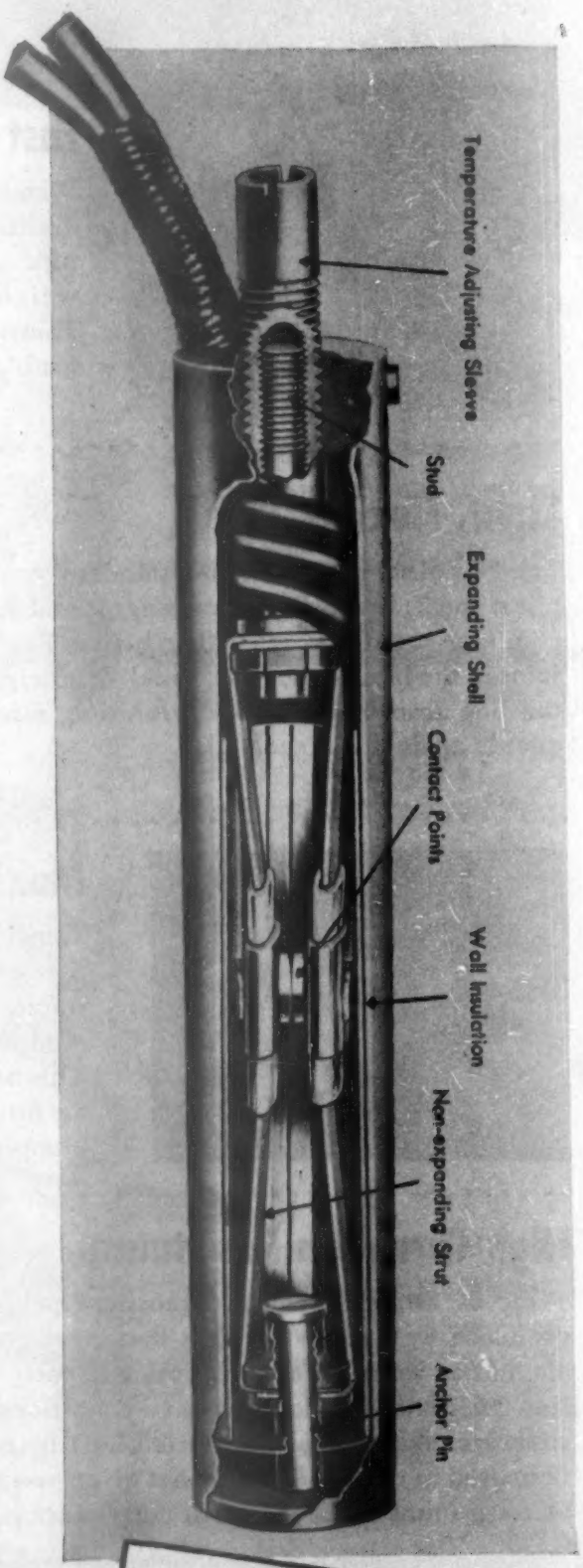
Multiple oilers with central shutoff and individual drop-feed control are suitable for use on machine tools, conveyors, chain drives. Oil is fed by gravity from a reservoir through multiple-gang-mounted sight-feed valves to any number of individual bearings up to 24. Drop-feed control of each valve allows independent regulation from full flow to a com-

Making Chocolate Behave ... All Along The Line



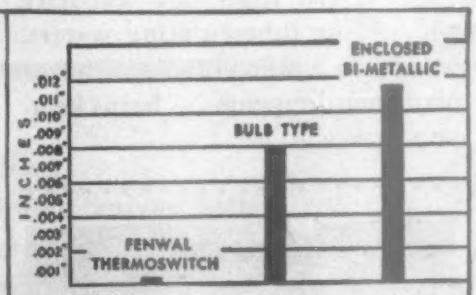
Few things are as fussy as chocolate when it comes to processing temperatures. That's why one candy manufacturer was looking for a dependable, accurate temperature control device for chocolate vats stationed at intervals along his production line. Installing Fenwal THERMO-SWITCH* Controls with a hand set temperature dial to operate solenoid valves in the vat steam jackets, he was able to keep the chocolate at the perfect consistency for best results . . . all along the line.

Case histories like this one show that the application of Fenwal Thermotechnics can solve important problems in industrial temperature control. Adaptable to virtually all the heat-transfer media, including applications in closed gas or liquid systems, incubators, ovens, ducts, warming and cooling cabinets, etc., THERMOSWITCH* Controls are rugged, positive in action, uniform in sensitivity, with negligible thermal lag. Maybe Thermotechnics can give *you* a simple, economical answer to your heat control problem.



MINIMAL VIBRATION EFFECTS

Fenwal THERMOSWITCH* Controls employ a light, stiff bridge structure which resists vibration and has a natural frequency far above those encountered in industrial applications. Chart shows amount of switch element motion when THERMO-SWITCH* is oscillated one tenth inch at 2000 cpm.



Fenwal

THERMOSWITCH*

Temperature Controls . . . Over-Heat and Fire Detectors

SENSITIVE . . . *but only to heat*

*Reg. U. S. Pat. Off

GET THIS BULLETIN

Contains additional facts . . . application data . . . tells how THERMO-SWITCH* Controls can meet your needs. Yours for the asking. Write: Fenwal Incorporated, 23 Pleasant Street, Ashland, Massachusetts.

9.8.7

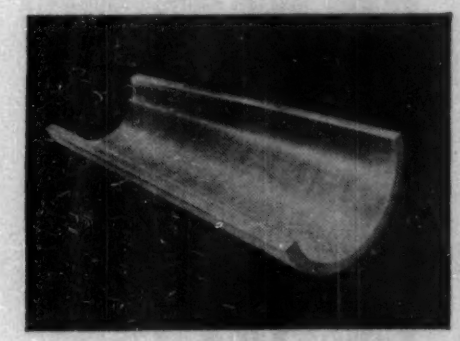
Which of these 4 TRANSITE* Advantages do you need in your water lines?

Fast Installation

Water lines go in fast when the pipe is Transite. The installation crew can lay more pipe per day because this pipe is light in weight, easily handled . . . and because Transite's factory-made joints are simply assembled on the job.

Tight, Flexible Joints

The Simplex Coupling, the standard coupling for Transite Pipe, was engineered to combine tightness with flexibility. Each joint in the line is a flexible "link" that helps the line absorb stresses and vibration, safeguards against leakage.



Maximum Flow Capacity

Transite Pipe has a smooth interior surface that offers minimum resistance to flow of water. And its initial high flow capacity cannot be reduced by tuberculating waters. This helps assure an ample volume of water for future plant requirements . . . helps keep pumping costs low.

High Corrosion Resistance

Made of asbestos cement, Transite Pipe is produced by a special process that develops maximum strength and exceptional corrosion resistance. Under corrosive conditions so severe that other pipe materials have been destroyed in months, Transite has given *years* of continuous service without deterioration.

For further information and engineering data about Transite Pipe, write Johns-Manville, Box 290, New York 16, New York

*Transite is a Johns-Manville registered trade mark.

Johns-Manville
TRANSITE PRESSURE PIPE
for Water Supply Lines • for Fire Lines • for Process Lines

plete shut-off. Adjustments are made by means of a friction screw. Oilers are made of aluminum alloy. The reservoir, usually of lucite, is supported by top and bottom caps between two cork gaskets. Hinged lid permits filling. For applications where temperature exceeds 150 deg. F., glass reservoirs and sights are available. Available in five sizes with capacities from 9 ounces to 1 gallon. Oil-Rite Corp., 3466 South 13th St., Milwaukee 7.

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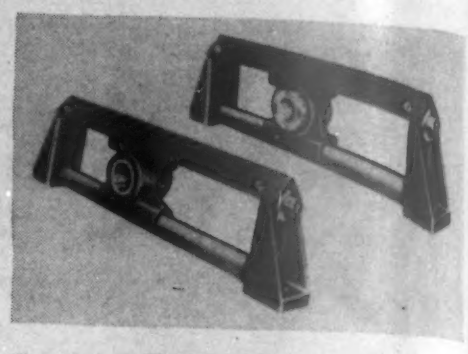


Screw Take-Ups

Two lines of screw take-ups, one with roller bearings, and one with babbitted bearings, have welded steel frames. Take-ups may be adjusted by turning screw heads at either end. Adjusting screws are plated, and the angle top member is said to provide protection against dust and dirt. Suitable for general conveyor and elevator service. Dodge Mfg. Co., Mishawaka, Ind.

•

Oven-Temperature Tester

Portable oven-temperature tester, designated Type DO-50, for checking the performance and efficiency of heating appliances, is a sensitive d.c. milli-voltmeter calibrated for use with iron copnic (constantan) thermo-couples having a resistance of 20 ohms. It was developed to aid in obtaining quick, accurate readings when checking new installation performance or the efficiency of ovens, control processing or heating equipment, and other appliances. Consists of a 3½-in. panel instrument with a compartment for storing the thermocouple assembly and leads. With a scale range from 0 to 650 deg. F, the instrument is said to have an accura-

If you're interested in valves that will give you any or all of these operating advantages then you'll be interested in

NON-CONTAMINATING

MINIMUM MAINTENANCE

NO VALVE STEM LEAKAGE

NO CORROSION

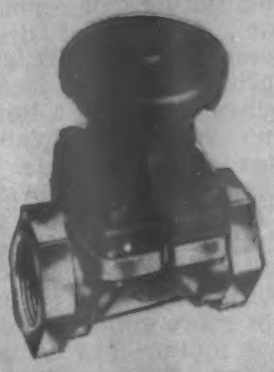
NO CLOGGING

NO SEEPAGE

GRINNELL-SAUNDERS DIAPHRAGM VALVES

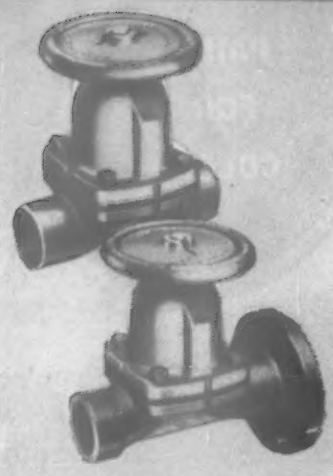
Valve Open

Valve Closed



FOR CHEMICALS

Stainless Steel valves with special diaphragms are handling satisfactorily such corrosive chemicals as phosphoric, acetic and chromic acids.



FOR BEVERAGES

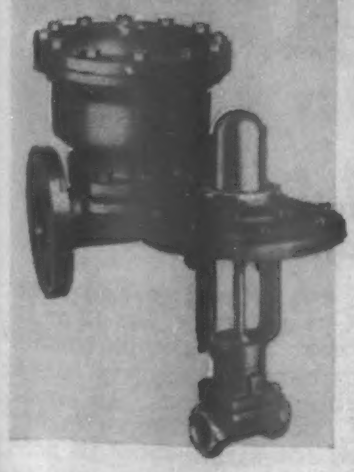
Bronze valves with socket ends (left) and with hose threaded end (right), both with special white rubber diaphragms, are stopping leaks and cutting maintenance to the bone in breweries handling millions of barrels of beer.

FOR PULP and PAPER

Rubber lined valves are setting new performance records handling pulp, alum and sulphuric acids in paper mills.

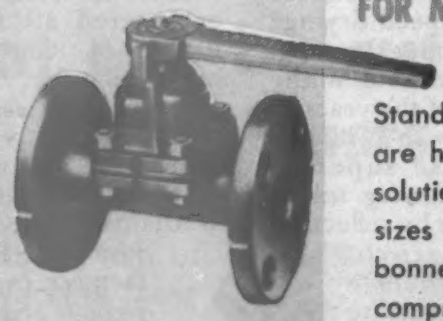
FOR TEXTILE PLANTS

Aluminum body valves with rising stems have won enthusiastic approval in bleacheries handling hydrogen peroxide and other chemicals.



FOR FOODS

Piston-operated valves (left) and air motor operated valves (right), both glass lined and with proper diaphragms, are providing remote control in plants handling sodium chloride, sodium hydroxide, sulphuric acid and fruit juices.



FOR MINES

Standard rubber-lined valves are handling highly abrasive solutions and slurries. Small sizes with quick-operating bonnets are widely used on compressed air lines to prevent leakage.

Grinnell-Saunders Diaphragm Valves may eliminate valve troubles and cut valve maintenance on your pipe lines. Available in any combination of valve bodies and linings, diaphragms and operating mechanisms. State your requirements or ask for Catalog 2-S on "Grinnell-Saunders Diaphragm Valves". Grinnell Company, Inc., Providence 1, R. I. Branch warehouses in principal cities.

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WHEN YOU'RE THINKING OF PLANT MAINTENANCE...

give it both barrels!

Dispense with half-way measures when you're thinking of paint for your plant—give it both barrels: Sherwin-Williams Save-Lite White for the light, cheery surroundings that eliminate eyestrain, speed production . . . Sherwin-Williams "prestudied" Color Harmony that promotes safety, reduces nervous tension, helps produce more and better products.

SHERWIN-WILLIAMS Save-Lite Whites

There's a Save-Lite White paint—flat, eggshell or gloss—that's right for *your* particular requirements! Need a Save-Lite White that gives outstanding resistance to fumes? One that resists *both* moisture and fumes? One that combines moisture resistance with high-speed drying? Then find out more about the great Sherwin-Williams Save-Lite White line! Take advantage of the years of research spent by Sherwin-Williams in formulating these superior whites! If you want *lasting whiteness* that *enhances safety* by reflecting more light, *reduces rejects, cuts unit costs*—you want a Sherwin-Williams Save-Lite White!

Products of SHERWIN-WILLIAMS Industrial Research

SHERWIN-WILLIAMS Color Harmony

Using one of the great variety of prestudied Color Harmony combinations, for walls and machinery, available from Sherwin-Williams, is like putting an extra force to work for you in your plant!

Sherwin-Williams Color Studios engineered all the colors into a group of comprehensive color harmonies that *increase output, improve working conditions, cut down costs!* We know many, many instances of the wonderful savings realized through the use of Sherwin-Williams Color Harmony. Here's just one—a radio tube manufacturer *cut breakage and rejections over 15% by recoloring his machinery.* Let us give you the full Color Harmony story! The Sherwin-Williams Co., Cleveland 1, Ohio. (Export Division, Newark, N. J.)

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cy of plus or minus 5 per cent of full scale value. Meter and Instrument Div., General Electric Co., Schenectady 5.

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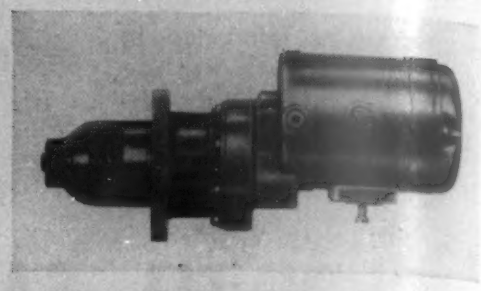

Engine Starter

Air cranking motor for starting diesel and gasoline engines is suitable for use where flammable liquids or combustible atmospheres render electrical starting of power units hazardous, according to the manufacturer. Starter comes as a complete ready-to-install unit, consisting of motor, reduction gear, drive, and drive housing. It weighs 43 pounds, and measures approximately 8 inches long by 5½ inches in diameter. Rotor and motor liner are chrome plated, and end plates are of bronze. A built-in, automatic oiler provides constant lubrication. Moisture from the air lines is used for supplementary lubrication. Under normal conditions, one motor may crank engines of up to 1000 or more cubic-inch displacement. Two motors may be used for larger engines. A 20-cu.-ft. storage tank at not less than 150 p.s.i. should provide about 30-sec. cranking. Leece-Neville Co., 6363 Hamilton Ave., Cleveland 14.

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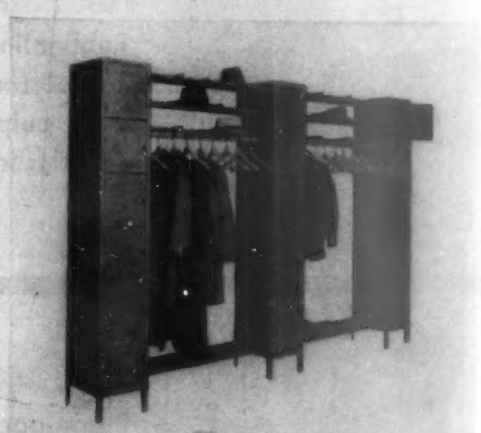


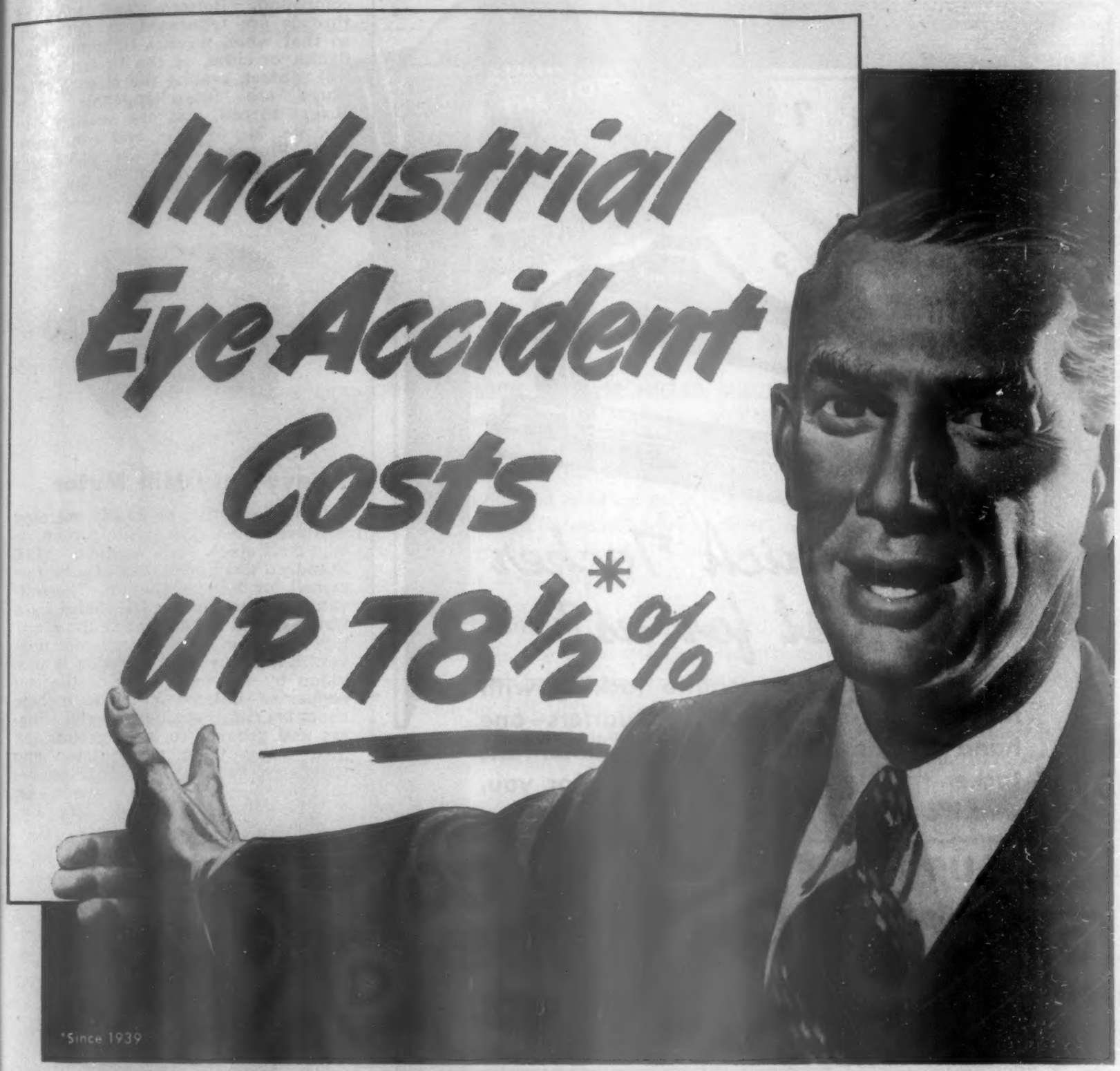
Coat-Rack-Locker Combination

Open-type coat rack, called The Office Valet—Lockerette, has 12 or 18 separated hat shelf compartments and spaced hangers, as well as a shelf for rubbers or shoes. An equal number of lock-box compartments are provided for safekeeping of personal effects. Manufacturer claims that the open-type rack keeps wraps dry and sanitary. Units can be set in single rows or back-to-back. Vogel-Peterson Co., 624 South Michigan Ave., Chicago 5.

•

Pipe Plugs

Metal-to-metal contact in pipe plugs, called Dryseal, is claimed to eliminate leakage without use of sealing



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According to the Society for the Prevention of Blindness, 98% of industrial eye accidents are prevented when shop workers wear safety goggles. Even in 1939, eye accidents cost industry well over $300 per injured man per year *in compensation alone.* TODAY THERE'S A 78½% "TAX UPON THIS TAX"!
What to do about it? Call in your nearest AO Safety Representative. Let him show you *how much* an adequate eye protection program has saved other plants in your industry, *how little* it will cost you and *how soon* it pays for itself!

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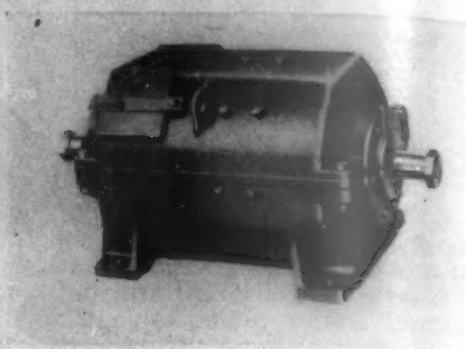
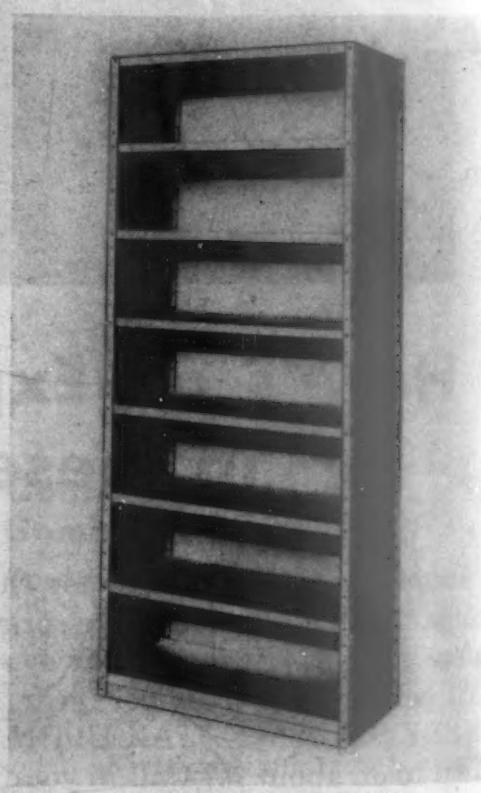
compound. Bottoms and tops of threads are truncated, or flattened, so that when wrench-tightened, the flanks, or sides, of the thread make full contact, sealing the closure. The plugs are interchangeable with Briggs thread, and are available in ⅛-, ¼-, ⅜-, ½-, ¾-, and 1-in. sizes. U. S. Plug & Fitting Co., 305 Frederick Bldg., Cleveland 15.



Heavy-Duty Mill Motor

Adaptable for use as totally enclosed non-ventilated or separately ventilated, d.c. steel mill motors, AISE Standard 600 Series, can also be furnished for self ventilation. The self-ventilated machines are cooled by a fan mounted at the rear of the armature; in the totally enclosed non-ventilated motors, fan action is provided by the back ends of the coil supports. Other features include short bearing housings, special slingers and grooves to keep grease and dust away from commutator and windings, bearing caps that are removable to facilitate inspections. Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.



Steel Shelving

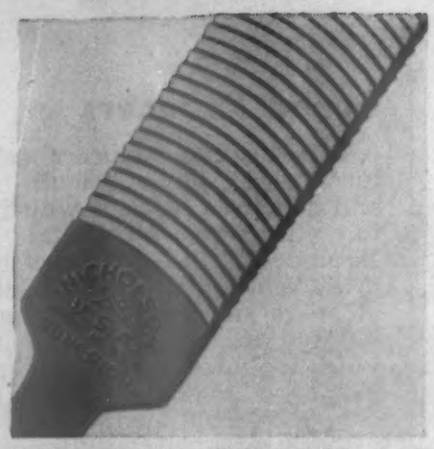
Open or closed steel shelving, which can be assembled to form a variety of units, is constructed of four posts with shelves 36 or 24 inches wide and 12, 18, 24, or 36 inches deep. Posts are available in heights of 87, 84, 48, 45, and 39 inches. End and back panels of the required size can

Subject: CURVED TOOTH FILES

"THE RIGHT FILE FOR THE JOB"

conserves materials, saves workmen's time, improves results—cuts production costs. This is one of a series of advertisements on kinds and uses of files. Save it, with the others, for shop and purchasing references.

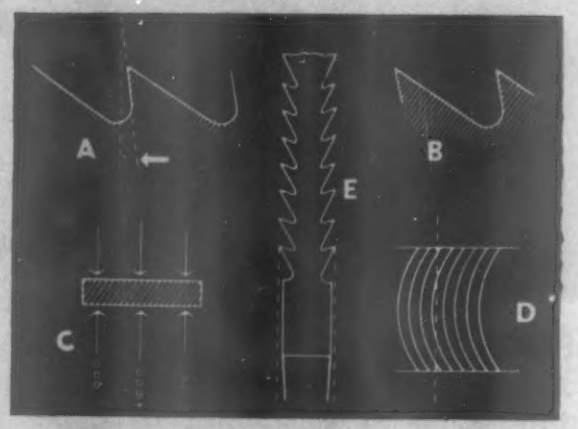
Prepared by Nicholson File Co.



Nicholson Superior Milled Curved Tooth File (Flat Rigid Tanged Type)

NICHOLSON SUPERIOR MILLED CURVED TOOTH FILES are made on newly designed Nicholson machinery and embody important improvements that fully justify the "superior" part of their name. Widely used by the automobile manufacturing and repairing industry on body work, they are nevertheless of great practical value in many other types of shop work. They are ideally fitted for smooth work on sheet and other steels up to the hardness of commercial annealed tool steel; and on cast iron, bronze, aluminum, zinc, babbitt, lead and plastics.

CONSTRUCTION. In the aggregate, little things make big differences in curved tooth files. Note the technical distinctions described and illustrated here. (A) Teeth have the proper face angle (positive) for good bite without pinning up. (B) Gullets are carefully designed and smoothly rounded for minimum clogging. (C) Cross-section has very slight fullness for even tooth wear and level cutting under normal filing pressures. (D) Tooth radius is designed to keep at least two teeth in contact with the work along any one line, to eliminate chatter. Greater shear angle at edges results in smooth cutting with less pressure, less clogging. (E) Preforged tang (in Rigid tanged type) has teeth stopped off to leave a clean shoulder *below level of teeth-tops* — insuring strength and allowing file to be used as a surfacing tool.



Nicholson Superior No. 25 Adjustable Flexible File Holder

RIGID AND FLEXIBLE TYPES. Besides the Flat tanged shape, RIGID Nicholson Superior Curved Tooth Files come in Half Round, Half Oval, Pillar and Square tanged shapes; Half Round Shell (teeth on convex side only) and Half Round Moulding (teeth on concave side only) — both with holes, instead of tang, for use in rigid-file holder. FLEXIBLE type comes in the Flat shape only — with holes for use in flexible-file holders. At left is shown the newest Nicholson holder design — made of lightweight aluminum with improved turnbuckle adjustment for using file on either concave or convex surfaces of varying degrees. Obtainable through industrial distributors.

Nicholson makes special-purpose files for Brass, Lead, Aluminum, Stainless Steel, Foundry Castings, Die Castings, Die Making, Lathe Filing, Curved and Shear Tooth Filing—and Swiss Pattern files of all shapes and sizes.

FREE BOOK, "FILE FILOSOPHY" — 48 instructive pages on kinds, use and care of files. Your foremen need it.

NICHOLSON U. S. A.

NICHOLSON FILE CO., 27 Acorn Street, Providence 1, Rhode Island
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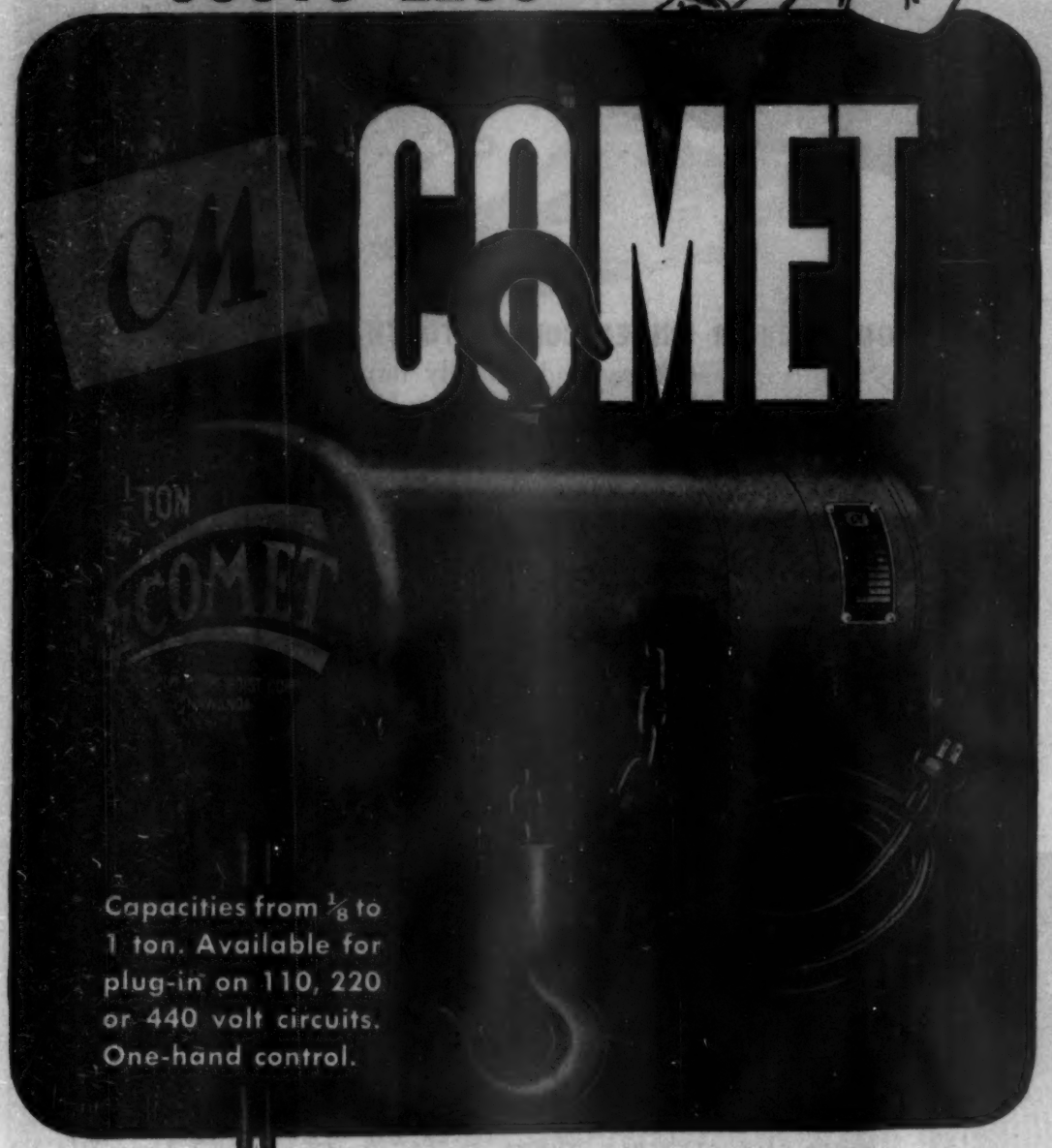

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be provided for making closed shelving; dividers are available to make the unit into any type of parts bin. Shelves are made of 18-gage steel; backs and sides are 22-gage; posts, 13-gage steel. Tri-State Metal Products, Inc., Box 1513, Pittsburgh 30.

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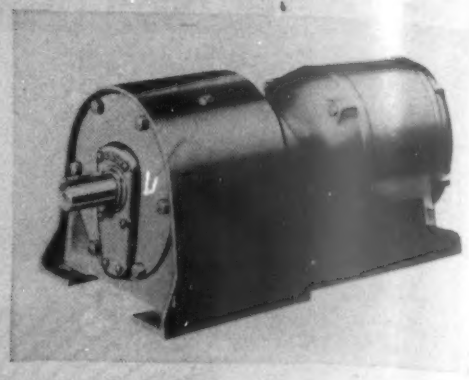

Speed Reducers

All-steel speed reducers, called Motoreducers, have smooth contours and generous sections which are said to eliminate accidental damage. Equipped with a dirt-proof, moisture-proof seal which protects lubrication of gears and bearings. Conservative horsepower ratings are said to provide trouble-free operation of all properly selected units. Line includes horizontal and vertical units in both integral and all-motor types, for floor, wall, or ceiling mount. Basic unit can be converted to right angle, V-belt, multi-speed, low ratio, and other adaptations. The Falk Corp., 3001 West Canal St., Milwaukee 8.

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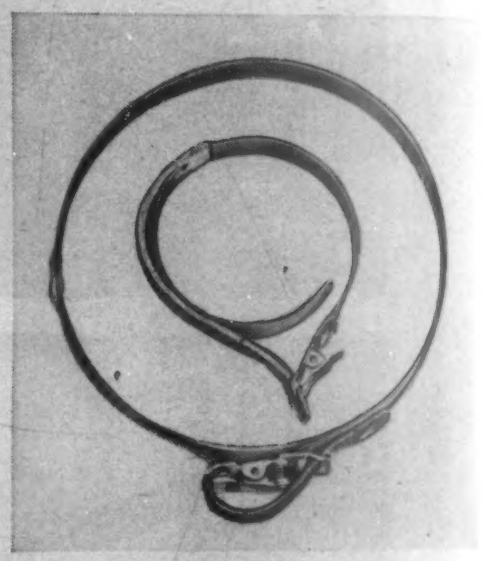

Flexible-Conduit Clamp

Low-pressure clamp, called Flexfast, for use with flexible conduits or tubing, is constructed of three parts permanently integrated into a single unit. It is said to provide fast, positive clamping action over diameters from 1½ to 37 inches, and to combine an overlapping, one-piece non-rusting metal clamping band with a strap and buckle take-up. Flexible Tubing Corp., Banford, Conn.

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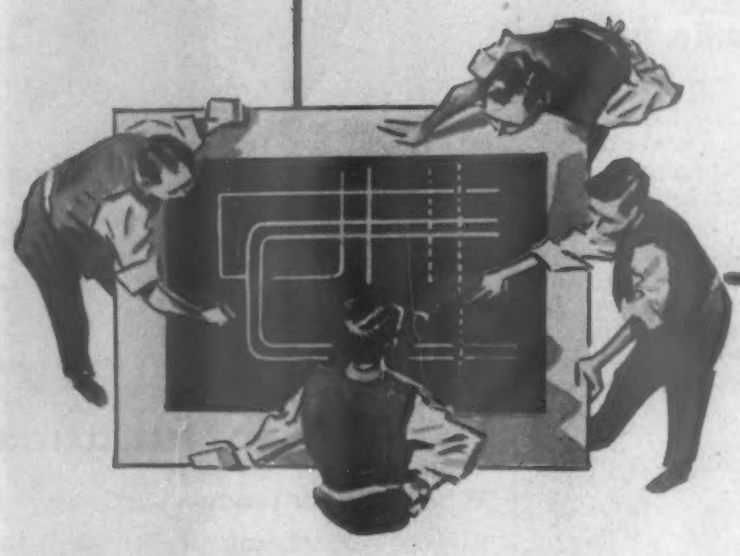
Floor-Drying Agent

Hard, granular material, called Industrial Floor-Dry, is said to possess high absorptive properties for oil, grease, and water dripping and is claimed not to be slippery or soggy

To Your Specifications

for



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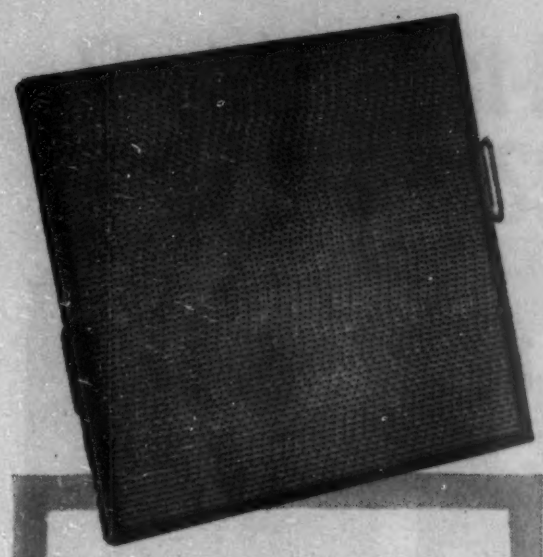
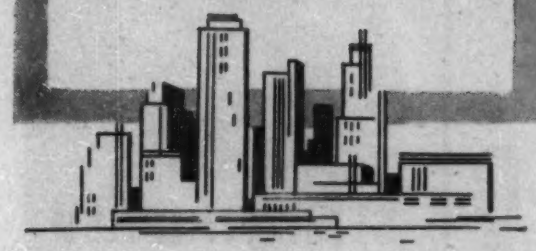


FAR-AIR* FILTERS



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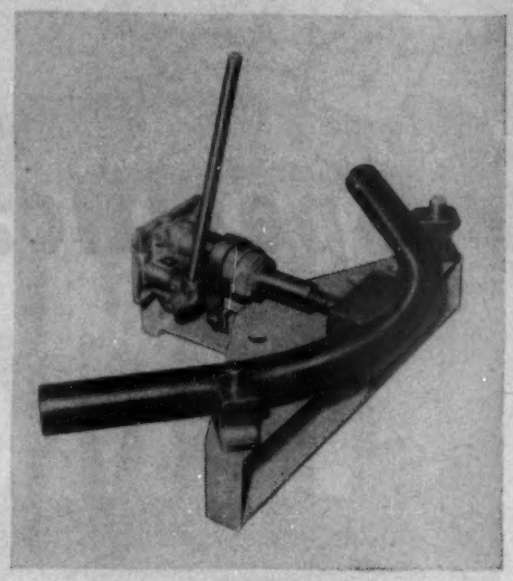

Portable Hydraulic Pipe Bender

Lightweight, portable tool with open-jaw construction was developed for use in forming smooth, uniform pipe bends right on the job. The 30-in. steel frame is electrically welded and heavily reinforced. Removable hydraulic jack can be used for other purposes. Combined weight of the jack and frame is 83 pounds. Electric Cord Co., 30 Church St., New York 7.

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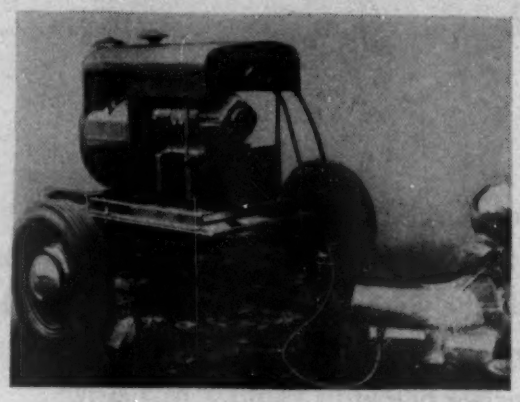

Engine-Driven D.C. Welder

Lightweight, engine-driven d.c. welder, suitable for general applications, weighs 660 pounds, provides a maximum of 250 amperes of welding current. Powered by a Wisconsin VF-4 air-cooled engine, speed-ratio-coupled by a steel-core V-belt drive to a GE Type WD-3200 generator with 50 per cent duty cycle. A fully calibrated dual control is said to permit accurate setting of a desired welding current before the arc is struck. Built-in auxiliary power outlet of 110 volts operates lights and power tools. Over-all dimensions are 44⅛ x 24½ x 35⅜ inches. Can be furnished mounted on a 2-wheeled, pneumatic-tired trailer with a standard 62-in. track. Welding Equipment Div., General Electric Co., Schenectady 5.

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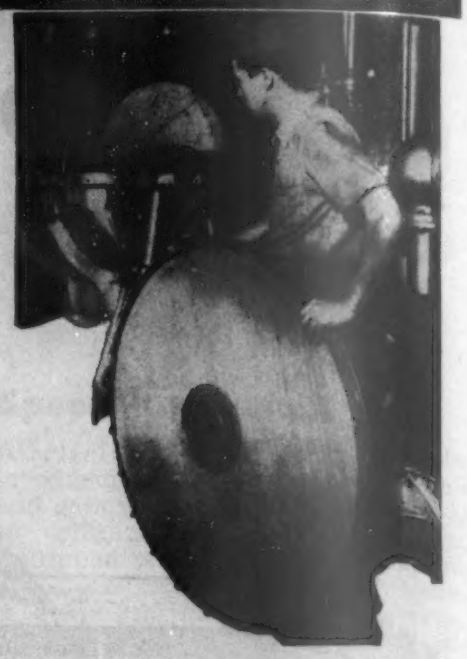
Soot Remover

Chemical, called Nalco SR-150, is said to remove soot by lowering its ignition temperature to 775 deg. F, where normal furnace temperatures

Cambridge
WIRE CLOTH and FABRICATIONS



These Cambridge-built leaves for Vallez Pressure Filter provide efficient filtration and clarity of product. Cambridge screens are available for replacement as well as in complete leaves.

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Whether your products are screened, filtered, or chemically treated, the Cambridge industrial wire cloth or fabrications designed especially for your problem are "JOB-FITTED" for maximum performance and operating economy.

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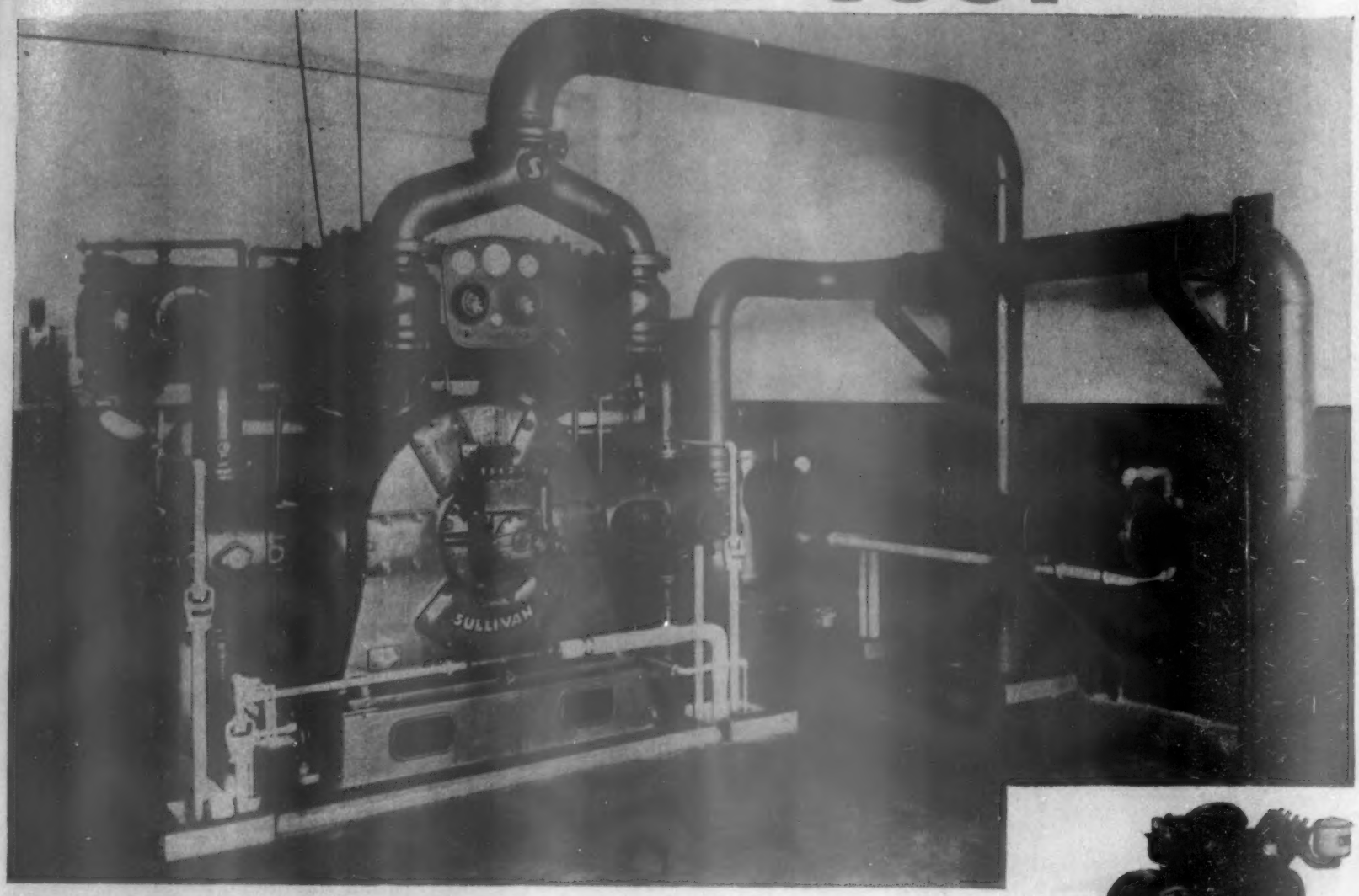
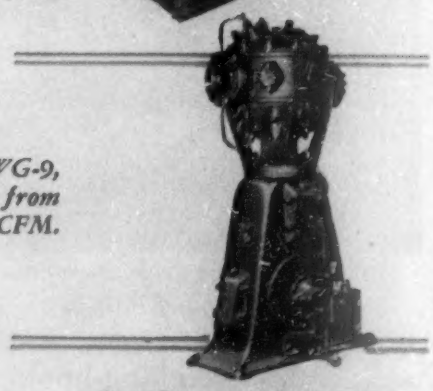


JOY WN-114 COMPRESSOR

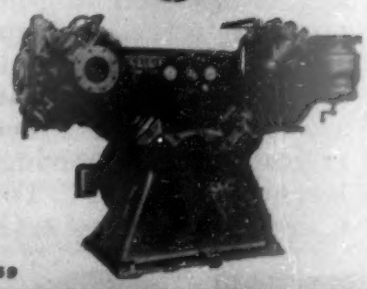
The JOY WN-114 is a four-cylinder, two-stage, double-acting compressor producing 1092 to 3656 CFM in single units, and up to 7312 CFM in twin units, depending on pressure. Exclusive "Dual-Cushion" valves provide top efficiency in low-cost air power. ● JOY builds the most modern compressors available for either centralized or decentralized air supply—*write for Bulletins.*

Consult a Joy Engineer

The JOY WL-80, in 9 sizes from 81 to 590 CFM.



The JOY WG-9, in 11 sizes from 153 to 822 CFM.



The JOY WN-112, in sizes from 378 to 1828 CFM.

W&D I 2059

JOY MANUFACTURING COMPANY

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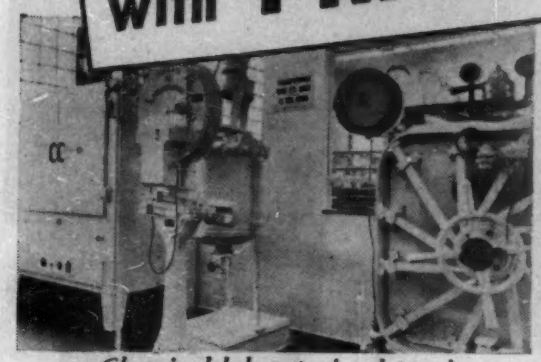

Chemical laboratories depend on Printweigh accuracy.

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Printweigh keeps stock room records RIGHT!

Prints BIG figures—ACCURATE weights —with split-second speed!

● Control your costs with Toledo PRINTWEIGH Scales—the modern answer for weighing-bookkeeping problems of industry! No *human* mistakes in reading, remembering and recording can slip in. Get set now with PRINTWEIGH speed and accuracy . . . keep weight records *right* in receiving, shipping, batching. Write . . . Toledo Scale Company, Toledo 12, Ohio.

Send for this ➡

New illustrated bulletin No. 2021 shows Better Ways to control costs.

TOLEDO

HEADQUARTERS FOR SCALES

will burn it off. Feeding of the material may be done under normal furnace operating conditions. It is furnished in powder form, which vaporizes on contact with the fire bed. The vapors penetrate the soot and bring about ignition, according to the manufacturer. National Aluminate Corp., 6220 West 66th Place, Chicago 38.

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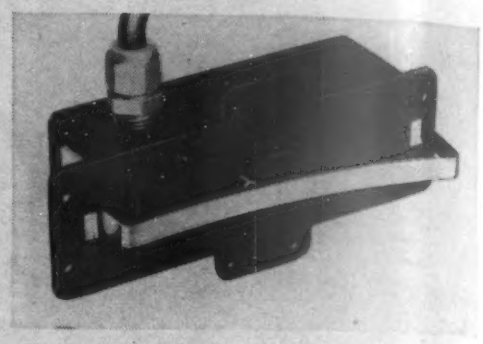


Splashproof Electric-Counter Switch

Cast-aluminum case of splashproof switch for actuating electric counters has fittings for waterproof cable, and is assembled with a gasket. Nickel silver arm, shaped to count circular objects ¾ inch or more in diameter without space between them, is depressed 3/32 inch for positive counter actuation. A force of 4.2 pounds is required for operation. Dimensions of the switch are 2x1⅞x1 9/16 inches, not including operating arm. Production Instrument Co., 700-06 West Jackson Blvd., Chicago 6

•

Fabric Conveyor Belt

High-tension fabric conveyor belt, called Raynile, a combination of rayon and nylon, is suitable for application where belt tensions run as high as 1000 pounds per inch of width, according to the manufacturer. Transverse flexibility is said to be provided by the nylon transverse threads; other features include minimum stretch in actual operation, and easy field splicing Reinforcement of the belt is accomplished by use of plies of rayon and nylon fabric bonded to each other, with the top cover bonded to the carcass by shock-absorbing and distributing cord breaker. Hewitt-Robins, Inc., Buffalo 5.

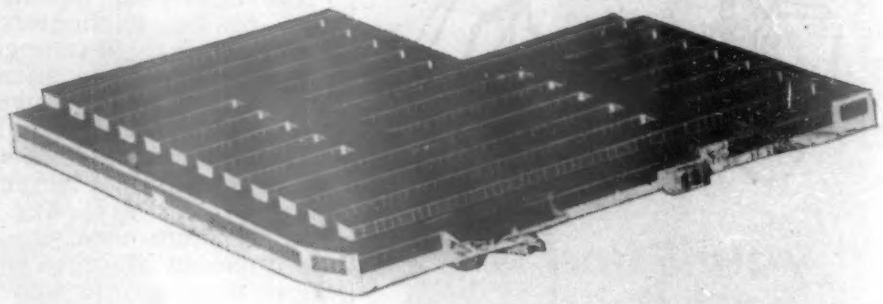
•

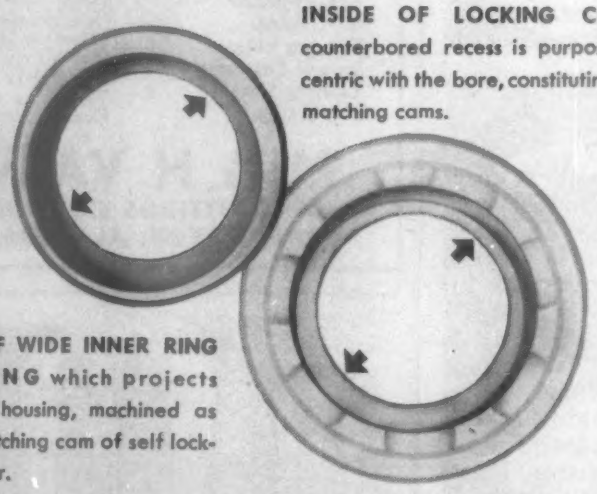
High-Speed Sander

Heavy-duty high-speed sander is powered for metal finishing, removing scale and rust with wire brush, and for smoothing welds and casting ridges with cup grinding wheel. Dust-laden air is diverted away from operator. Equipped with ball-type rear handle and thumb-operated switch; reversible side handle can be used on either side of tool. Switch, commutator, and brushes are protected against abrasive dust and grit. Heat-treated alloy steel gears are encased in grease-tight covering. Universal motor, 25 to 60 cycles, 110 volts; also available for 220 or 250 volts. Weight is 12½ pounds; length, 15⅜ inches. Equipped with rubber pad, 7-in. sanding pad, grit abrasive

DEMAND "built" this new 100,000 sq. ft. plant for the manufacture of FAFNIR Wide Inner Ring Ball Bearing Transmission Units

• It's as obvious as the simple principle of the Fafnir Wide Inner Ring Ball Bearing. Because no other ball bearing transmission unit is as simple and easy to install and remove, so many manufacturers wanted these units that Fafnir could not delay construction: a whole new plant had to be erected to satisfy the demand.





INSIDE OF LOCKING COLLAR . . . counterbored recess is purposely not concentric with the bore, constituting one of two matching cams.

END OF WIDE INNER RING BEARING which projects through housing, machined as cam, matching cam of self locking collar.

DESIGN "built" the demand

Available in a complete line of transmission bearings . . . pillow blocks, hanger boxes, cartridges and fan boxes . . . of which the most popular for all around utility is the light type "LAK" Pillow Block. The Fafnir Bearing Co., New Britain, Conn.

NO MACHINING . . . The shaft is slipped . . . not pressed or forced . . . through the pillow block. Then the self-locking collar is slipped over the shaft onto the inner ring hub or cam.

NO ADAPTERS, NO LOCKNUTS . . . A quarter turn of the collar engages the recessed cam in the collar with the corresponding cam on the inner ring hub, locking the inner ring to the shaft.

DOUBLE LOCKED . . . As a final precaution, the set-screw is tightened, exerting a wedging action which holds the collar always in engaged position even under shock or reversing loads.

• Just as easily disengaged . . . by backing off the set-screw and turning the collar in the reverse direction to disengage the cams.

MOST COMPLETE LINE IN AMERICA

FAFNIR BALL BEARINGS

When you need specific information on materials, equipment or services, reach for your Sweet's File for the Process Industries (the big gray file). It contains 212 manufacturers' catalogs full of useful information on thousands of products . . . from absorbers—gas, to wood preservatives. Cross indexing speeds finding.

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disks, spanner wrench, and 3-wire flexible rubber-covered cable. U. S. Electrical Tool Co., Cincinnati 14.

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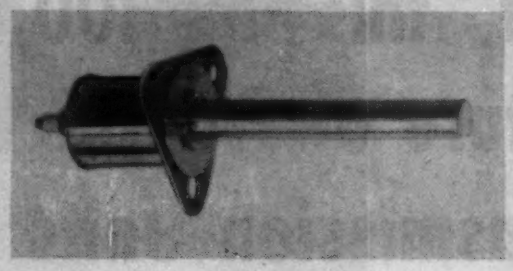

Thermal Switch

Pivot of 1.4-oz. thermal switch is said to be frictionless and nonwearing. A high-temperature magnet is used both to quench any arcing and to act on the pivot to provide fast action. Switch has hermetically sealed, stainless steel housing, and is adjustable to any temperature from minus 75 to 1250 deg. F. Can be changed from normally open to normally closed by replacement of electrical terminal. Designed primarily for fire detection, but applicable for cycling control of heating and refrigerating systems, handling oils, chemicals, and other uses. Airite Products Co., 3526 Union Pacific Ave., Los Angeles 23.

•

Chute Flow Device

Designed to provide uniform and steady flow of bulk material from bins, hoppers, and chutes, aerating device, called Bin-Flo, is a small plate, 3¾x7½x½ inches over-all, located at points where flow is restricted. Air from low-pressure supply is injected into the material at these points through fabric diffuser. Even the most finely ground material will not plug up when the device is used, according to the manufacturer. Units are made for thin-walled bins and chutes as well as for concrete and other thick-walled containers. Bin-Dicator Co., 14615 East Jefferson Ave., Detroit 15.

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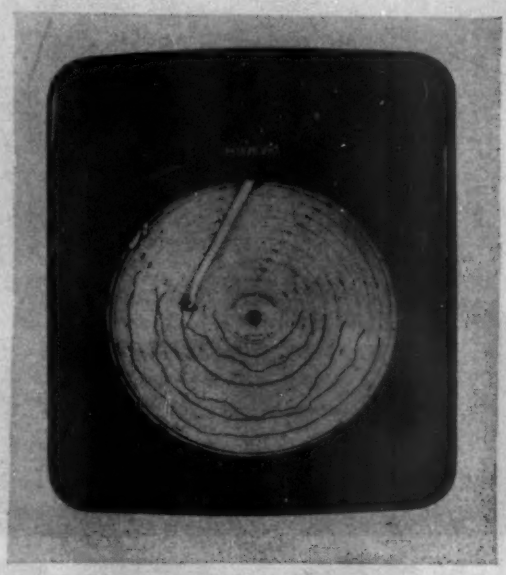

Electronic Recorder

High-speed multi-record Dynalog electronic recorder makes from one to six different records of closely spaced colored dots on one circular chart. Unit has one measuring system, either resistance bulb or emf.

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type; switching unit automatically brings the vari-colored pens into recording position at 6-sec. intervals, in any desired sequence. Sequence and number of points may be changed at will. Color-coding prevents mismating of circuits and pens. Pen wheel holds six recording pens which are magnetically selected in turn, and held in recording position by a single pen arm. May be used for measurement of temperature, pressure, humidity, liquid level, pH, conductivity, speed, and other process variables. It is claimed that "dry ink" provides clean recording, and that the instrument will operate continuously for several weeks without re-inking. The Foxboro Co., Foxboro, Mass.

•

Skid Box

Heavy corrugated corrosion-resistant steel panels with double reinforced corner angle construction, rolled edge top, and cast and forged steel latches are features of skid boxes that are available with discharge doors of various types. Formed channel legs provide floor protection, and box can be used with lift trucks or crane. Phillips Mine & Mill Supply Co., 2227 Lane St., Pittsburgh.

•

Rubber-Covered Wire

Rubber-covered braided building wire (R, RH, and RW) is covered with a sheath woven of inert, inorganic fibers of high dielectric strength. These fibers are said to be flexible, strong, unaffected by moisture or temperature changes. Also that they cannot burn or rot, are immune to all ordinary acids and alkalis, and repellent to fungus and rodents. Wire is small in diameter

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Smear, smudge or splatter stainproof Varlar and try to mar the beauty of this revolutionary wall covering which washes clean with ordinary soap and water.

PROVE to yourself how oil, ink, grease, jam, crayon, lipstick—STAINS OF ALL KINDS—wash right off Varlar quickly, easily with ordinary soap and water. See how beautiful, how durable and clean a really modern wall covering can be. Laboratory tests show that 25,000 soap-and-water scrubbings can't mar Varlar's luxurious new coloring or stain resistance.

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But don't take our word for it. Get first-hand proof by testing a sample of beautiful, stainproof Varlar . . . absolutely free! Smear, smudge or splatter it. Then quickly, easily wash it clean with ordinary soap and water. Mail the coupon for your free test sample of Varlar today.

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On behalf of my fellow Montanans, you are invited to make this pleasant land—the Treasure State—your home and your future.

Cordially yours,

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Unite with Union Pacific in selecting sites and seeking new markets in California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, Oregon, Utah, Washington, Wyoming.

*Address Industrial Department, Union Pacific Railroad, Omaha 2, Nebraska

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and light in weight, and has a smooth, slick finish. Available in Nos. 14 and 12 B. & S. Triangle Conduit & Cable Co., New Brunswick, N. J.

•

Water Demineralizer

Water demineralizer, called Hydrion, produces mineral-free water by the passage of any water through a column of ion-exchange resins. Water produced is said to be equivalent in chemical purity to distilled water. No heat, cooling, or power is required. Wall-mounted, unit is attached to any faucet by a rubber adapter, which is provided. No special skill is needed for its operation. Electronic indicator shows quality of converted water at all times. Demineralizer consists of three parts—a replaceable cartridge, a wall-type cartridge holder, and the electronic indicator. Each cartridge is said to remove more than 1100 grains of dissolved minerals; the number of gallons of pure water delivered depends on the mineral content of the water in the locality. When the cartridge is used up, it is necessary only to replace it with a new one. Weight of unit, without cartridge, is 5 pounds; cartridge weighs 4 pounds. Purity indicator operates on 110-120 volts, 50-60 cycles a.c. Can be supplied for 110 volts d.c. Inlet and outlet rubber tubing and adapter are included. A. E. Tomkin & Co., P.O. Box 7311, Washington 4, D.C.

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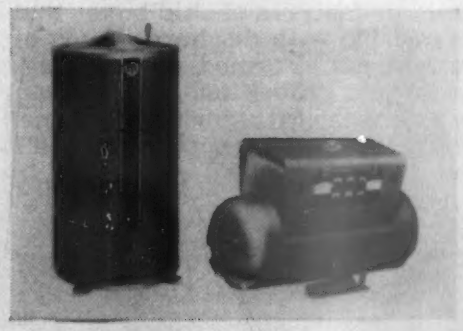

Arc Welders

Lines of a.c. and d.c. arc welding machines includes a.c. units of the transformer type, available in 150-, 200-, 300-, 400-, and 500-amp. capacities, and motor-driven d.c. units in 150-, 200-, 300-, and 400-amp. capacities in a compact 3600-r.p.m. model and in the conventional 1750-r.p.m. type. The a.c. unit features built-in power-factor correction; fingertip, stepless current control; fan-forced ventilation; wide current range; moderate open-circuit voltage operation. All d.c. models have a one-dial control panel on which is a series of marked outlets, each for an electrode of different diameter. Metal & Thermit Corp., 120 Broadway, New York 5.

•

Steam Trap

Inverted bucket-type steam trap is said to be suitable for drainage of tracer lines, drying cans, boiling pans, press platens, sterilizers, molds, and similar equipment. Known as the "60," it is furnished with seat orifices of various sizes, for working

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ANSWER BY
CARBORUNDUM
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Through an extensive program, The Carborundum Company is making selection and application of the best abrasives to use for specific jobs simpler and more efficient. "Series 20" is a timely example. In a relatively narrow pattern of grits and grades, these wheels cover a wide range of grinding operations. The smaller number and variety of wheels that need be stocked is only one of several important benefits realized.

Easier to specify and order, products by CARBORUNDUM, repackaged and relabelled for fast identification, explain another reason for their growing preference by users of abrasive products. The Carborundum Company, Niagara Falls, New York.

CARBORUNDUM
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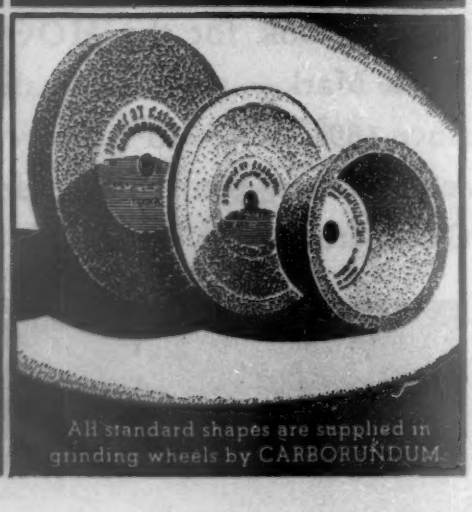
Specialized wheels by CARBORUNDUM for thread grinding

Diamond wheels to meet stiffer technical needs.

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

Cool-cutting GREEN GRIT wheels for cemented carbide

A coated abrasive for every sanding and finishing condition



All standard shapes are supplied in grinding wheels by CARBORUNDUM

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No other Mobile Crane of this type has all the features of ***KRANE KAR***. You get more speed, more work, more safety. Loads and Unloads freight cars, trucks, trailers—Stacks and Stores—expedites Plant Maintenance.

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pressures up to 150 p.s.i. and temperatures up to 375 deg. F. Free-swinging, postive-seating guided disk is self-aligning and remains centered with seat opening, according to the manufacturer. Piping arrangement features a choice of horizontal or vertical connections at either inlet or outlet or a combination of both. The Clark Mfg. Co., 1830 East 38th St., Dept. T., Cleveland 14.

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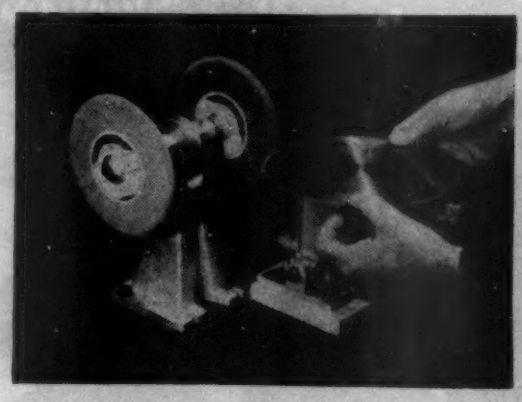

Saw Blade Sharpener

Circular saw sharpening fixture, which holds and turns saws for accurate sharpening while keeping the saw round, may be mounted on the same base with power-driven grinding wheels. Grinding wheels of two different shapes sharpen three types of circular saws. One wheel has a 45-deg. angle on one side, is used for sharpening cross cut or fine teeth. The other wheel is 5/16 inch wide, with a radius for use on ripsaws and for large teeth on combination saws. Fixture is designed to bring the saw teeth up to the grinding wheel at right angles. Treyco Products, Buffalo 17, N. Y.

•

Automatic Clutch

Automatic clutch for electric motors and gasoline engines from ¼ to 5 horsepower, called C-1000, is mechanically balanced, self-actuating in either direction of rotation, and has the same characteristics in either direction. May be mounted on horizontal or vertical shafts, and is equipped with a combination sheave for use with *A* or *B* belts. It is bored for any shaft from ½ to 1 inch in diameter. Clark Clutch Div., All Steel Welded Truck Co., Rockford, Ill.

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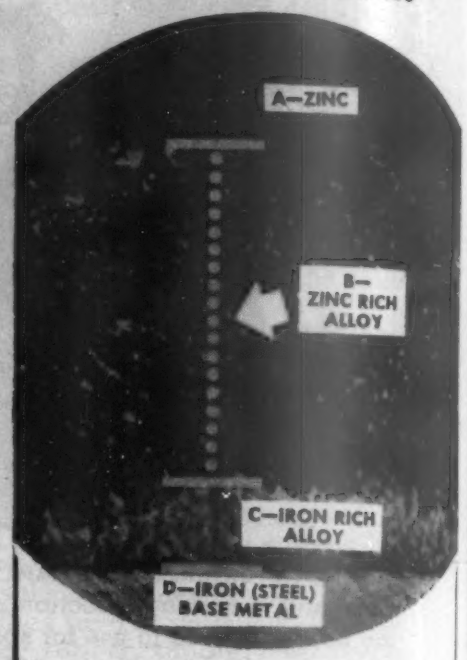
Wet-Dry Vacuum Cleaner

Wet-dry vacuum cleaner, designed for small and intermediate jobs,

ONLY HOT-DIP GALVANIZING
alloys molten zinc to base metal



The infallible testimony of the microscope reveals *why* the application of molten zinc through the *Hot-Dip Galvanizing process* provides the utmost in rust prevention. Protective zinc (A) is first *bonded* to the base metal (D) by an iron rich alloy (C)—then a layer of rich zinc alloy (B)—obtainable only through the Hot-Dip process—*seals out* destructive elements that cause rust and corrosion.

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Time has convincingly proved, by thousands of case histories, that the Hot-Dip Galvanizing method, as employed by members of this Association, *does* provide longer life, greater uninterrupted service and effects tremendous savings in expensive maintenance and replacement costs.

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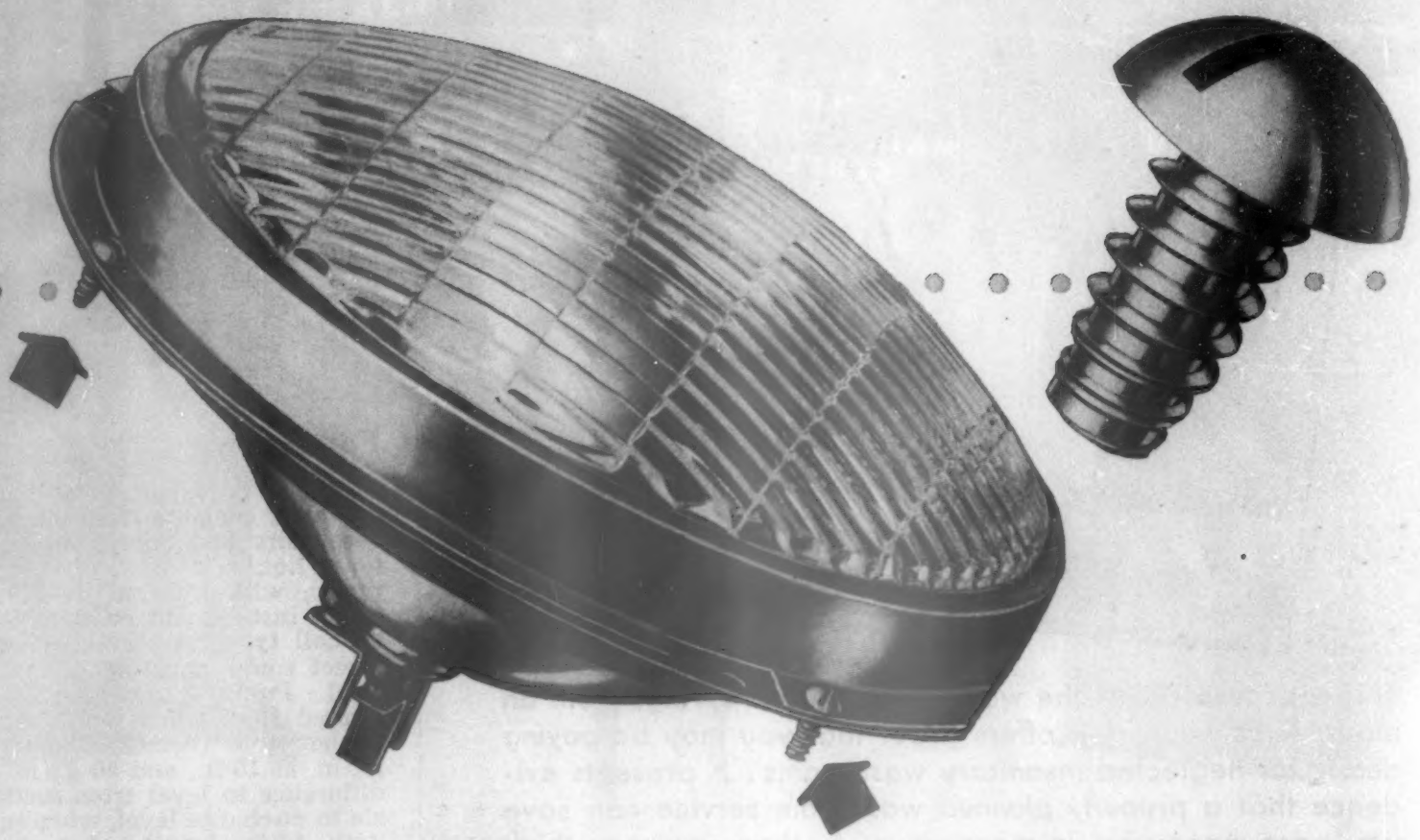
For membership roster or any information in regard to *your* particular corrosion problems, address The Secretary, American Hot Dip Galvanizers Association, Inc., First National Bank Bldg., Pittsburgh, Pa.

hot-dip
GALVANIZING

COMMON SENSE ASSEMBLY ENGINEERING

THE SIMPLER
P-K
FASTENING METHOD

Spots a Saving of 1¢ per Unit



When the See-Mor Lamp Co. tried to fasten their Sealed Beam Headlight Adapters to the lamps with machine screws, rejects piled up because screws stripped out of the sheet metal, and tap breakage also became a serious problem.

They soon found that the P-K "common sense" method was simpler, faster and cheaper. After switching to P-K Type "Z" Self-tapping Screws, they reported assembly savings of $1.72 on every thousand screws driven, or 1¢ per lamp . . . a substantial percentage of the total fastening cost. And in addition the P-K Screws had the desired holding power in the thin metal.

Why not "spot" similar savings in your plant? There's no profit in running up needless assembly costs with tapping, riveting, nut running, or inserts in plastics that slow up molding, if you can use the simpler P-K fastening method. Often, P-K Screws allow improvements in product design as well as savings in assembly costs.

Ask a P-K Assembly Engineer to examine your assembly. In 7 out of 10 cases he can demonstrate that P-K Self-tapping Screws will save up to 50% in work-hours. If you prefer, mail assembly details for recommendations. Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.

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PARKER-KALON PRODUCTS COLD-FORGED SOCKET SCREWS, WING NUTS, THUMB SCREWS • HARDENED SCREWNAILS AND MASONRY NAILS
SHUR-GRIP FILE AND SOLDER IRON HANDLES • METAL PUNCHES • DAMPER REGULATORS AND ACCESSORIES

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This brochure points the way to *unexpected* savings from an *unsuspected* source! It offers proof that you may be *paying dearly* for neglected insanitary washrooms . . . presents evidence that a *properly planned* washroom service can save you more money . . . in more ways . . . than you may think possible . . . An "Ideal Washroom Maintenance Service" cites telling facts and figures — lets you discover for yourself how West can improve your employee relations, and also effect impressive savings in labor, time, and maintenance materials. And at unbelievably low cost, too! *West has "serviced" industrial washrooms from coast-to-coast for over half a century!*

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weighs about 25 pounds. Its over-all height is 2 feet, diameter 14 inches. The 5-gal. tank is made of aluminum. Machine rides on one ball-bearing swivel caster and two fixed wheels. Filter adapts cleaner to either wet or dry pick-up work. Built-in air circulating system cools ⅝-hp. motor with outside air instead of air from vacuum tank exhaust. Multi-Clean Products, Inc., St. Paul 1, Minn.

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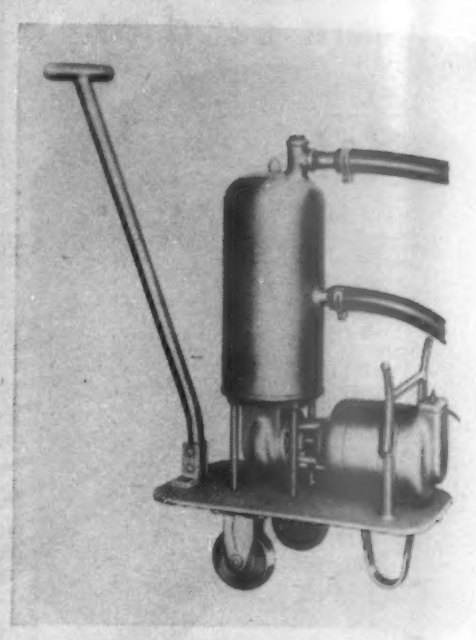

Pump

Portable pump unit for rapid removal of coolants from machine tool reservoirs and sumps or for transfer of liquids, consists of a centrifugal pump, with internal discharge features, installed in combination with a shell type reprime chamber, with direct communicating discharge and inlet. Pump is mounted on a fabricated steel truck which moves on rubber-tired casters. Capacity is 40 g.p.m. at 15-ft., and 50 g.p.m. at 3-ft. difference in level from suction nozzle to discharge level, when equipped with 10-ft. length of suction and 10-ft. length of discharge hose. Motor is ¾ horsepower, 3450 r.p.m., in standard voltages and current characteristics. The Ruthman Machinery Co., Cincinnati 2.

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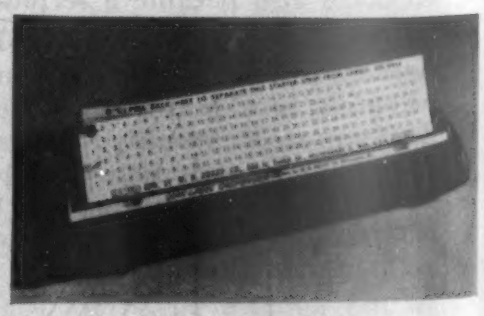


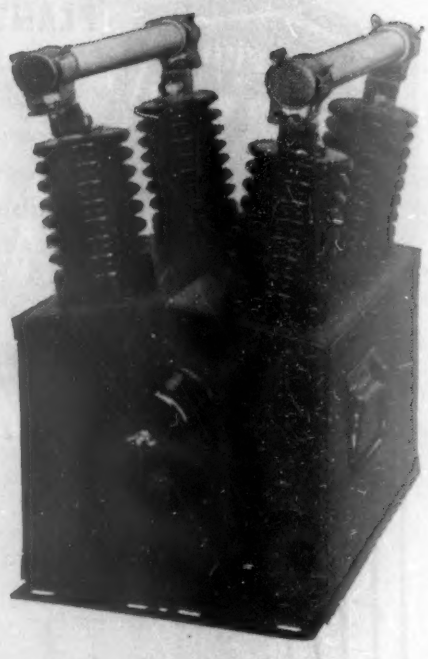
Motor Lead Markers

Useful to those engaged in the building, installing, and repairing of electric motors, Underwriters' approved adhesive motor lead markers and motor connection diagrams are made of material that withstands continuous heat up to 300 deg. F., according to the manufacturer. They are said to have high dielectric strength and insulation resistance. Labels, called Quik-Labels, will not curl, dry out, or fall off. The thermosetting adhesive causes them to bond perma-

High, Wide & Handsome!

ALLIS-CHALMERS INSTRUMENT TRANSFORMERS

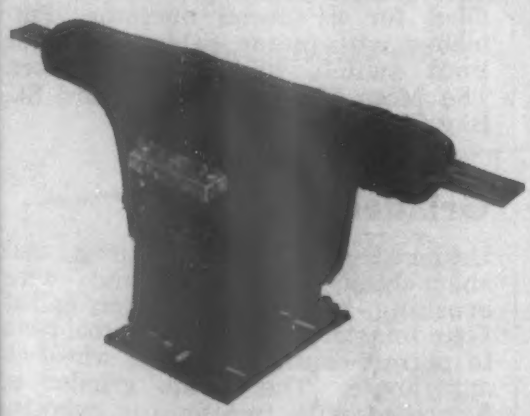
- HIGH THERMAL CAPACITY
- WIDE RANGE OF TYPES, SIZES
- NEAT, HANDSOME LOOKING!



1. Easy to inspect — maintain — and the Type CW meets rigid requirements for accuracy for metering or relay applications. This oil filled outdoor current transformer furnished in ratings 15 to 69 kv; 10 to 800 amperes. Liberal design! Withstands overcurrent.

2. Accurate primary metering outdoors—wound type, compound filled current transformer in 5 to 15 kv classes. Pole top crossarm or substation steel mounting arrangements. Type CWD-1 (5 kv), CWD-2 (8.7 kv) and CWD-3 (15 kv) rated 10-800 amperes.

3. Ideal characteristics for heavy duty, accurate metering. Uniformly low phase angle and ratio errors in this line of Type PD compound filled potential transformers. Ratings 200 VA, up to 14400-120 volts, with current limited fuses, or unfused.



4. Get high accuracy over a wide range of burdens with this small heavy duty indoor current transformer. Built to ASA-NEMA standards and EEI dimensions. Furnished in Types MKE-5 kv, K2E-8.7 kv, K3E-15 kv, 10 to 800 amperes. Double secondary winding if desired. Call an A-C representative, or send coupon to ALLIS-CHALMERS.

ALLIS-CHALMERS

Pioneers in Power and Electrical Equipment From Generation Through Utilization

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ALLIS-CHALMERS, 1078A SO. 70 ST.
MILWAUKEE, WIS.

Send Catalog 152, which contains dimensions, specifications and accuracy curves of Allis-Chalmers instrument transformers.

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Company.....

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City.....State.....

Another outstanding INDUSTRIAL CAFETERIA installation for one of America's leading companies...

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PLANT FOOD SERVICE SPEEDS PRODUCTION

Food service, *right in the plant*, cuts noon-time delays...builds health...builds morale...steps up output. And the *right way* to serve good, nourishing food is with PIX equipment. Best of all, it's adaptable to any size plant and to any budget, large or small. Write us today for complete information.

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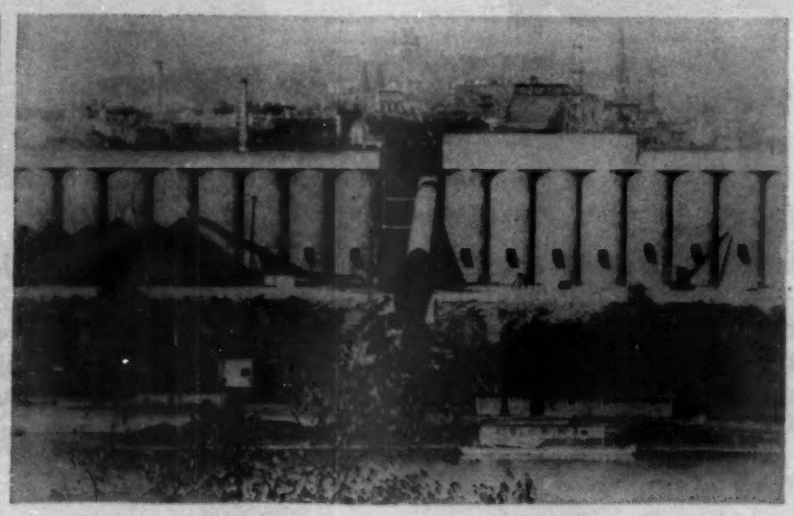
2159 Pershing Road, Chicago 9, Ill.



OHIO RIVER COAL HANDLED IN 24 NEFF & FRY SILOS

Coal from barges is conveyed into these Neff & Fry Super-Concrete Stave Silos which have 4,000 tons storage capacity. Average hourly delivery via truck is 300 tons. From the gates in the four bins at the right, two gondolas are simultaneously loaded in five minutes. The Hatfield Campbell Creek Coal Co., Cincinnati, operates the plant.

This is typical of our many large installations of storage bins for the economical handling of flowable bulk materials—coal, chemicals, cinders, lime, sand, grain, seeds, sawdust, ore, water, etc., etc.

Before you invest in cylindrical storage bins for any kind of material, investigate the applications and advantages of Neff & Fry silos. We'll be glad to give you complete information.

THE NEFF & FRY COMPANY

CAMDEN, OHIO

NEFF & FRY STORAGE BINS

nently to wires, cover plates, and motor frames under high temperatures, and they are not affected by cold, moisture, or vibration. Nineteen motor hook-ups and 30 of the most generally used motor lead markers are available. W. H. Brady Co., Dept. 126, 815 North Third St., Milwaukee.

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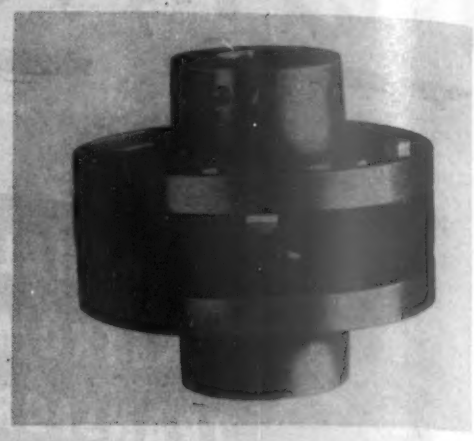


Couplings

Line of couplings is available in 17 sizes. At 1750 r.p.m., sizes 1/50 to 15 horsepower have 15-deg. torsional deflection under rated load; sizes 30 to 100 horsepower have 3-deg. deflection. Manufacturer states that couplings will accommodate at least 2-deg. angular and 1/32-in. parallel misalignment. Neoprene flexing elements operate in shear and are bonded to steel plates. Couplings are said to require no lubrication and to be unaffected by abrasives. Lord Mfg. Co., Erie, Pa.

•

Floor-to-Floor Materials Handling

Materials handling installation, called Stairlevayor, for moving materials from floor to floor, is adjustable for width, length, and pitch of stairway. Can be erected wherever needed, either with a small wedge-shaped recess at the stairway base or in conjunction with a short ramp. It can also be set up as a lift over present wood or concrete stairways, or in any open space, with or without steel treads, inside or out. Manufacturer states that no special shaft space or reinforcement is needed. Pushbutton controls at every floor eliminate need for a special operator. Furnished with motor, cables, automatic limit switch, and electric brakes. The Moto-Flow Co., 110-A 23rd St., Bay City, Mich.

•

Grinder

Designed for grinding, buffing, tool sharpening, polishing, and wire brushing, bench-type grinder, called Grindmaster, has adjustable tool rests to permit contact with the wheel at any angle. The ¼-hp. grinder is furnished with two 6x¾-in. wheels, one coarse, one fine. Wheel guards and transparent eyeshields provide protection for the operator. Toggle type switch and 6-ft. cord and plug are supplied. Motor is standard Torq single-phase, in ¼ and 1/3-hp. ratings. Torq Electric Corp., 1050 Interstate St., Bedford, Ohio.

AVOID THE LUXURY TAX

on Idle Horsepower

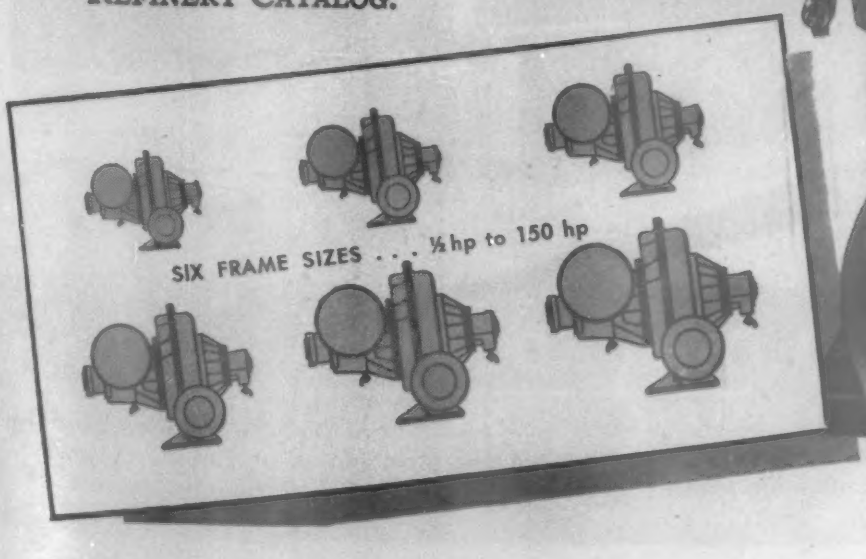
When your horsepower needs are small, why pay the extra cost of larger turbines, designed for much more power than you require?

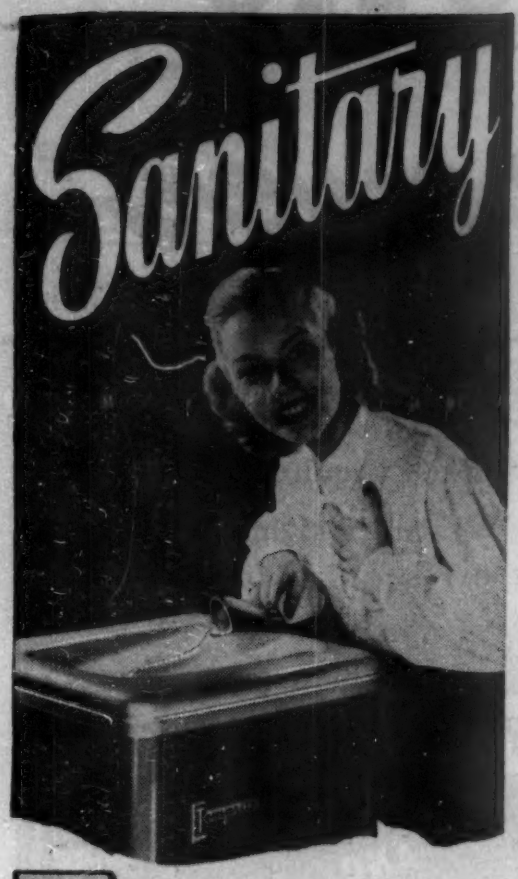
You pay only for the horsepower you need when you fit the right Coppus "Blue Ribbon" Turbine to the load. They're made in six frame sizes . . . from 150 hp down to fractional . . . priced in proportion to their size.

That's why you'll see more and more Coppus turbines powering pumps, blowers, fans, stokers and other equipment requiring a steady source of small hp. *Steady* is the word for these busy little turbines. Like all Coppus "Blue Ribbon" products (blowers, ventilators, gas burners, etc.) each Coppus turbine is precision-made, with close tolerances checked by Johansson size blocks. And before shipment, the turbine you get is dynamometer-tested.

No wonder more than 85% of all orders for Coppus turbines since 1937 have been repeats . . . and that a growing number of nationally known manufacturers are installing "Blue Ribbons" on their original equipment.

Write for Bulletin 135–10. COPPUS ENGINEERING CORPORATION, 111 Park Avenue, Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG and REFINERY CATALOG.





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DRINKING WATER COOLERS

1. Bubbler design gives maximum sanitary protection. **2.** Smart, streamlined styling blends harmoniously into all surroundings. **3.** Effortless finger-tip pressure produces a steady stream of perfect-temperature drinking water. **4.** No spouting, no splashing, no annoying fluctuations in water flow.

User Protected by Temprite's 5-Year Warranty Plan

All models meet requirements of the National Bureau of Standards and Underwriters Laboratories, Inc.

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TEMPRITE PRODUCTS CORP.

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YOU WANT TO KNOW

more about the items on this page

Letters to the addresses given will bring you further information.

SPEED PACKING MANUAL has 199 step-by-step photographs and drawings with instructions for packing a wide variety of products. Section on corrosion prevention. Sherman Paper Products Corp., Newton Upper Falls 64, Mass.

ANCHOR NUT. Spring steel "Snap Nut" for blind panels is pressed into assembly position directly on work surface. Designed for easy entrance of screw, even in cases of extreme misalignment. Prestole Corp., 3123 Bellevue Rd., Toledo 6.

METALS MANUAL. Copperbase Casting Alloys, 52 pages. Treatise on non-ferrous metallurgy. Illustrated. Compilation of standard inquiry specification tables. Federated Metals Div., American Smelting & Refining Co., 120 Broadway, New York.

"TELLING EMPLOYEES About Business Operations: The Company." Employee report, 56 pages. Study of techniques used to inform employees. Metropolitan Life Insurance Co., 1 Madison Ave., New York 10.

CHECKING GAGE for optical comparators or projectors. Checks mirror adjustments and magnifications of lenses. Engineers Specialties Division, 980 Ellicott St., Buffalo 8.

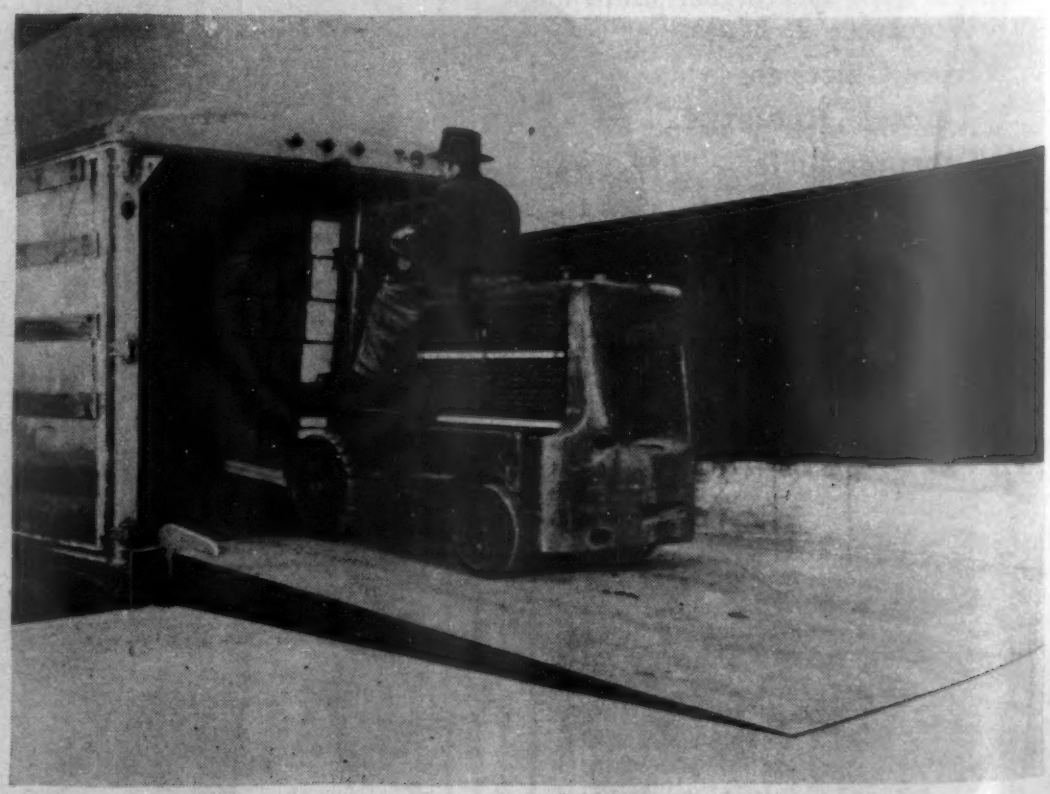
SYNTHETIC ENAMEL developed to replace porcelain for some uses. Superclad can be baked with infrared or convection equipment. Said to withstand acid, alkali, humidity, salt spray, abrasion. Sherwin-Williams Co., 101 Prospect Ave., N.W., Cleveland.

MAGNESIUM BRAZING process now available. Furnace, flux dip, and torch methods are applicable. Parts too thin to be welded can be brazed. Dow Chemical Co., Midland, Mich.

MICROFILM CAMERA. Designed to film large or long tracings or maps while copy is in motion. Projects flow enlargements on emulsion paper or cloth back to full size or any scale reduction. Diebold-Pratt & Gray Laboratories, P. O. Box 127, Norwalk, Conn.

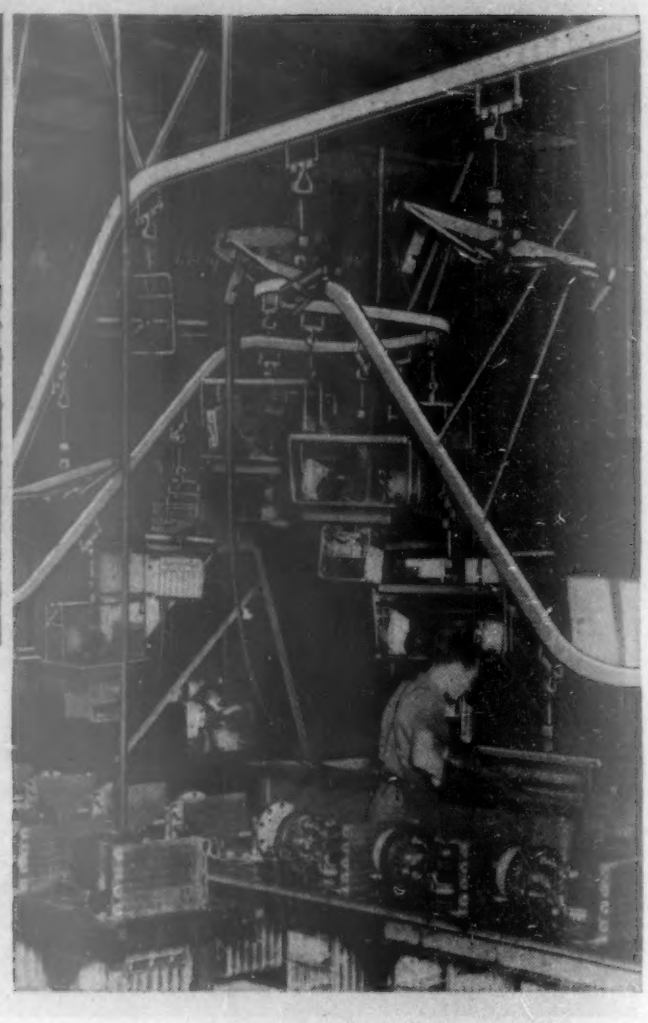
TAPE-SEALING MACHINE applies masking tape to drums, rolls, canisters, and cartons up to 17 inches in diameter. One moving part. Single rotation of swivel arm does job. Readinger Corp., 20 South 15th St., Philadelphia 2.

LABEL PRINTER. Imprints codes, batch numbers, expiration dates, contents information on small rectangular and die cut labels of any shape. Vacuum feed. Automatic



DOCK ELEVATOR adjusts to truck floor level. Leva-Dock is a hinged platform supported by a hydraulic jack. No need for steel plates or ramps. Adjusts to truck level throughout loading or unloading. Rotary Lift Co., 1054 Kansas St., Memphis, Tenn.

Eggs or Electrical Appliances . . .



Richards-Wilcox

IN AND AROUND UP AND DOWN

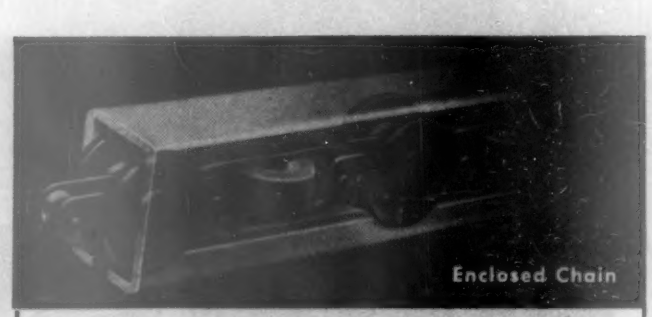
ZIG ZAG

Continuous Power Conveyor

Solves Production Problems

There is practically no limitation to the purposes for which ZIG-ZAG Conveyors can be used. Designed to carry light loads within a confined space . . . to break "bottlenecks" . . . ZIG-ZAG adds efficiency and economy to any production line . . . advantageously handles anything from eggs to electrical appliances. Find out exactly how the revolutionary R-W ZIG-ZAG Continuous Power Conveyor will benefit your production-picture. Consult our engineers at the Richards-Wilcox office most convenient to you. Write or call today.

1880 • Over 68 Years • 1948



Engineered for Economy and Flexibility

- Horizontal and vertical units alternate in a continuous chain traveling through special steel tubing.
- Complete flexibility for installation in any plant. Easily installed, easily changed to conform to plant alterations.
- SAFE—all moving parts fully enclosed.
- Low first costs. Low Power Factor.
- Standard horizontal or vertical curves—two-foot radius. (Stock load pendants including automatic turning units available.)

Richards-Wilcox Mfg. Co.

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A heading machine cutting sections from heated steel rods and compressing them in a die to a rough spherical shape.

The steel is carefully chosen and inspected, even before it gets to the heading machine. After being "born" here, balls are carefully "brought up," through a long series of grinding and lapping operations, to the unbelievably high standards of finish, sphericity and precision which have made Strom Metal Balls the standard of Industry. Strom Steel Ball Co., 1850 South 54th Avenue, Cicero 50, Illinois.

Strom BALLS Serve Industry

Largest Independent and Exclusive Metal Ball Manufacturer

shutoff. Labels stacked after printing. Adolph Gottscho, Inc., 1 Hudson St., New York 13.

"HANDBOOK for Gummed Tape Users." Covers all types of moistening devices. Guide to selection, moistening, application of gummed tape. Care of tape machines. Better Packages, Inc., 45 Waggoner St., Shelton, Conn.

DRY LUBRICANT. Molykote adheres to smoothest surfaces. Low friction coefficient. Operates at high, low, room temperatures. Effective under extreme pressures. Alpha Corp., 1 Seneca Pl., Greenwich, Conn.

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PLASTIC SPRAY. Krylon is transparent plastic coating supplied in self-contained sprayer. Flexible coating resists discoloration, water, alcohol, alkali, acids, numeral oils, grease, chemical fumes. Special solvent removes it. Foster & Kester Co., Inc., Reading North Broad St. Station Bldg., Philadelphia 32.

"ABC'S of the Taft-Hartley Labor Act." Reference booklet for supervisors. General Foods Corp., 250 Park Ave., New York 17.

ELECTRONIC MICROMETER is capable of measuring dimension of an object while it is moving rapidly and vibrating. Accurate to plus or minus 0.0001 inch. Can be used to produce automatic control. Raymond M. Wilmotte, Inc., 1469 Church St., N.W., Washington 5, D.C.

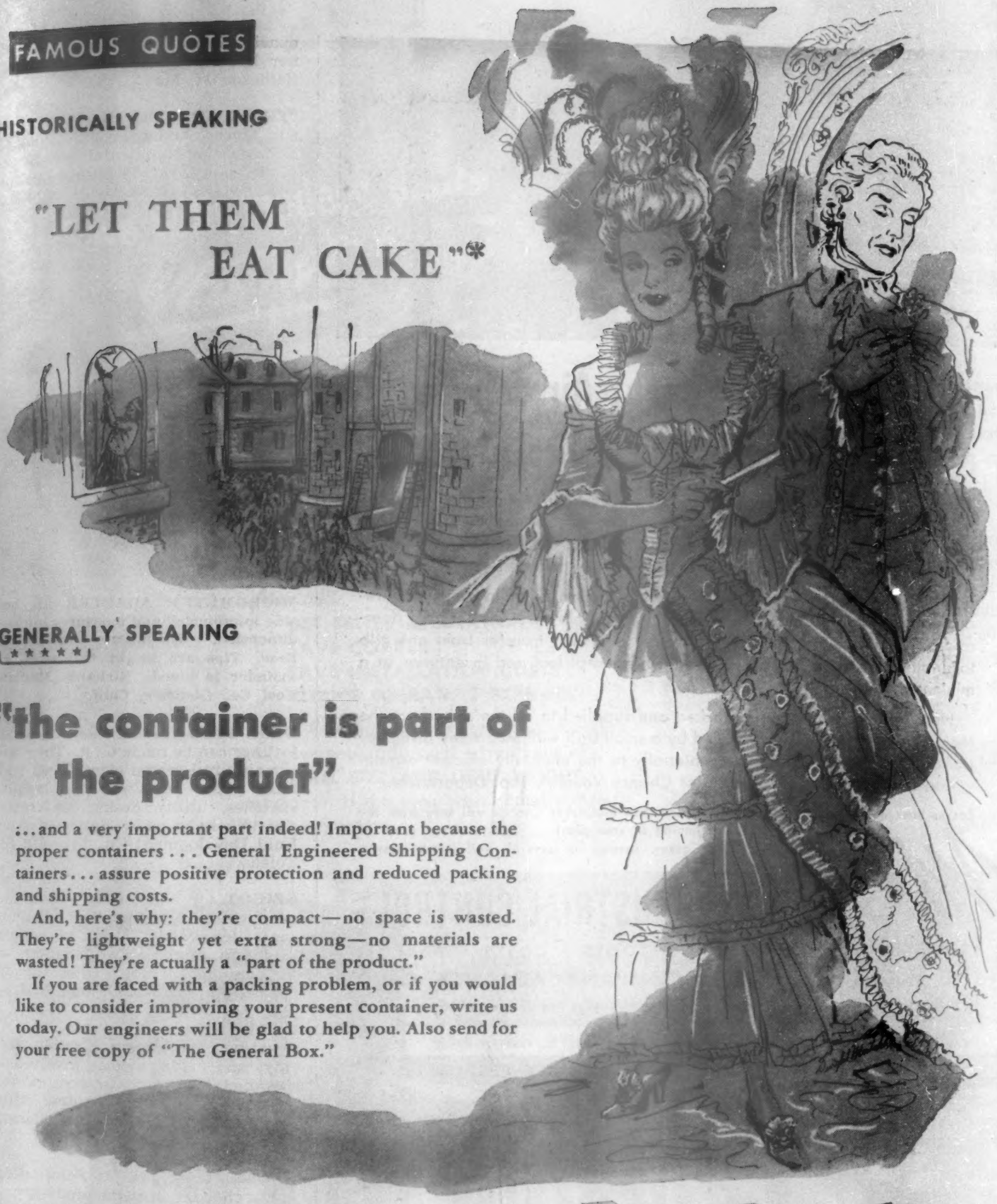
TIME COMPUTER. Designed for overtime and irregular hour problems in payroll calculation. Shows working time in hours, deducts lunch periods. Slide-rule type. Plastic. Hourmaster, P.O. Box 533, Westfield, N. J.

COLOR MATCHER is designed for comparison of paint samples. Applicator makes dual film samples on coated paper for color, gloss, and

FAMOUS QUOTES

HISTORICALLY SPEAKING

"LET THEM EAT CAKE"*



GENERALLY SPEAKING

★★★★★

"the container is part of the product"

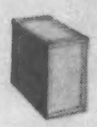
...and a very important part indeed! Important because the proper containers . . . General Engineered Shipping Containers . . . assure positive protection and reduced packing and shipping costs.

And, here's why: they're compact—no space is wasted. They're lightweight yet extra strong—no materials are wasted! They're actually a "part of the product."

If you are faced with a packing problem, or if you would like to consider improving your present container, write us today. Our engineers will be glad to help you. Also send for your free copy of "The General Box."

**Marie Antoinette* (1755-1793), *Queen of France. When told that her suffering subjects had no bread, it is reported that she said: "Let them eat cake."*

General Nailed Box



General Cleated Corrugated Container

General Corrugated Box

GENERAL BOX COMPANY... engineered shipping containers

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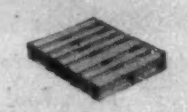
504 N. Dearborn St., Chicago 10, Ill.
DISTRICT OFFICES AND PLANTS: Brooklyn, Cincinnati, Detroit, East St. Louis, Kansas City, Louisville, Milwaukee, New Orleans, Sheboygan, Winchendon, Natchez. Continental Box Company, Inc.: Houston, Dallas.

General Wirebound Crate

General All-Bound Box



Generalift Pallet

McCaskey Tool Control in Typical Chance Vought Crib.

How Chance Vought Aircraft Cut Breakage and Other Tool Costs

The Chance Vought Aircraft Division of United Aircraft Corporation adopted McCaskey Tool Crib Control for three cribs ten years ago. Lower tool costs—cut in a dozen ways—quickly proved its value and the McCaskey controlled cribs have increased to 16 with the growth of the plant.

McCaskey Control has been particularly effective in locating and reducing breakage during periods of both top employment and normal operations. Complete accountability for tools and their transfer from one crib to another on the basis of usage data have kept loss and inventories at a minimum.

New and reclaimed tools, stocked and supplied to all the cribs from the Main Tool Crib, are also controlled by a small staff with McCaskey Inventory Control. McCaskey contributes materially to the unusually efficient organization and economical operation of Chance Vought's Tool Department.

Let us have a qualified representative explain how McCaskey Control will save from the beginning in your plant . . . or send you proof of McCaskey savings in several well-known plants.

McCaskey INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • TOOLS • COSTS • PAYROLL

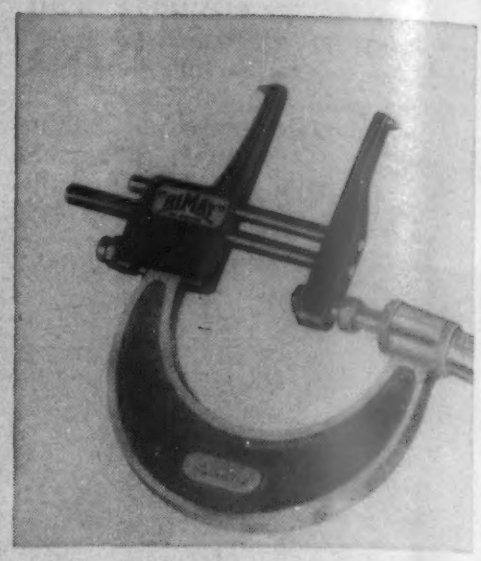
THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems Ltd., Galt, Canada — The McCaskey Register Co., Watford, England

McCaskey Inventory Control in Main Tool Crib.

opacity comparisons. Henry A. Gardner Laboratory, Inc., 4723 Elm St., Bethesda 14, Md.

"TESTS FOR TRUTH—Truth Versus Myths About Profit." Booklet. Discusses governmental control of profits and prices. The Eddy-Rucker-Nickels Co., 4 Brattle St., Cambridge 38, Mass.



MICROMETER ADAPTER fits outside micrometer and measures internal dimension. One-minute installation time. Tips are bright tool steel, remainder is blued. Richards Machine Tool Co., Glendale, Calif.

DESK PAD, vinylite. Pen or pencil jottings can be made on it. They will remain until erased or removed with fluid. Can be used for layouts, sketches, utility desks, conference, and telephone pads. Range of sizes. Ruhl Development Co., 241 16th St., Toledo.

SPIGOT for 5-gal. cans admits air; permits steady liquid flow. Thumb-controlled valve. Made of copper, cadmium plated. Two adapters to fit popular threads. Klex Co., 30 North 15th St., East Orange, N. J.

FILMS

Precision Investment Casting portrays and explains steps involved in this metal forming process. Color, sound, 16 mm., 12 minutes. Allis-Chalmers Mfg. Co., Gen. Machinery Div., Milwaukee 1.

Brushes Are Made for Painting reviews changes in paint products and formulation in relation to brushes and brushing technique. Devoe & Raynolds Co., Inc., 44th St. & First Ave., New York 17.

Mighty Labors answers the question "What Is Industrial Engineering?" Ninety scenes from actual plants. All phases of time study, methods engineering, job evaluation, plant layout, process charting, and wage incentives are demonstrated. Thirty-four minutes. Industrial Engineering College, 3309 West Washington Blvd., Chicago 24.

Save with modern distribution systems using WESTINGHOUSE Dry-Type Transformers

If you are expanding or relighting your plant, you can lower operating costs and gain greater efficiency feeding motors and lights by using a modern distribution system.

In such a system, higher voltages are brought close to the load and are stepped down at the motors and lights they serve with modern, dry-type transformers.

You will:

GET BETTER REGULATION
SAVE COPPER
SAVE INSTALLATION COSTS
REDUCE OPERATING EXPENSES

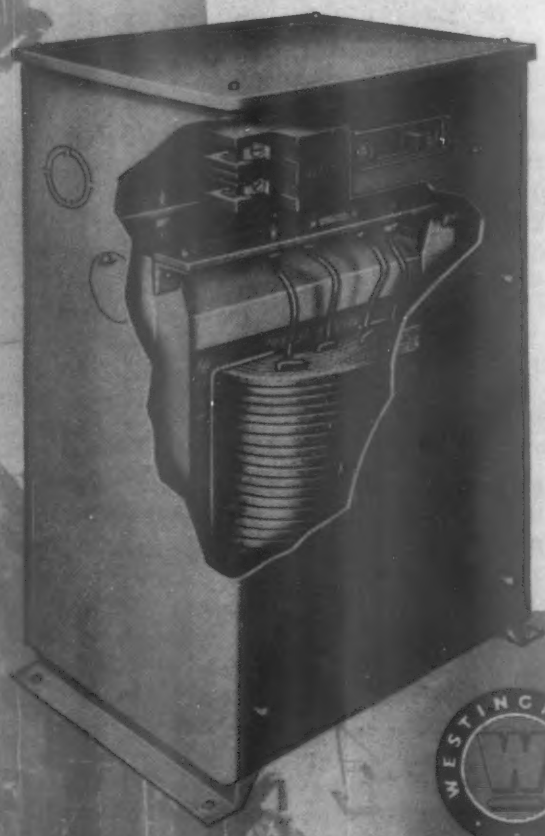
And Westinghouse dry-type transformers will give you additional advantages of **SMALL SIZE AND LIGHT WEIGHT,** important to the men who actually install the transformers.

To get these extra "plus" advantages, Westinghouse leadership in engineering introduced Class B insulation and developed HIPERSIL*, the steel that carries one third more magnetic flux.

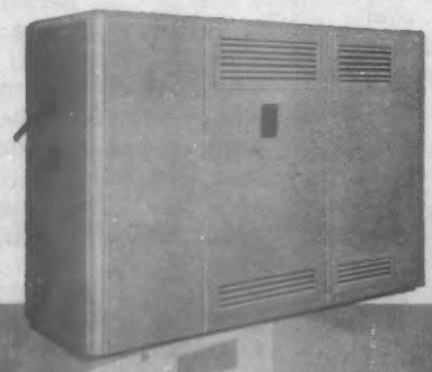
That same engineering is ready to assist you with the proper application of dry-type transformers in the distribution system best suited to your needs. Call or write your near-by Westinghouse office for your copy of Booklet B-4009. Westinghouse Electric Corporation, Transformer Division, Sharon, Pennsylvania. J-70517

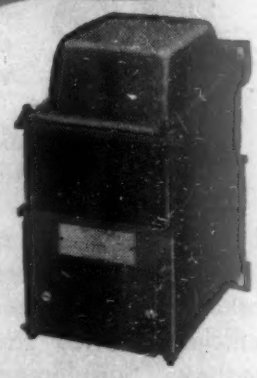
Reg. U. S. Pat. Off.

YOU CAN BE SURE IF IT'S Westinghouse



A NEW FEATURE—Two popular dry types, AJR and AVR, are now offered with or without a built-in circuit breaker. With this new feature, the need for separate protective devices is reduced. AVR-B (with breaker) is shown at left.





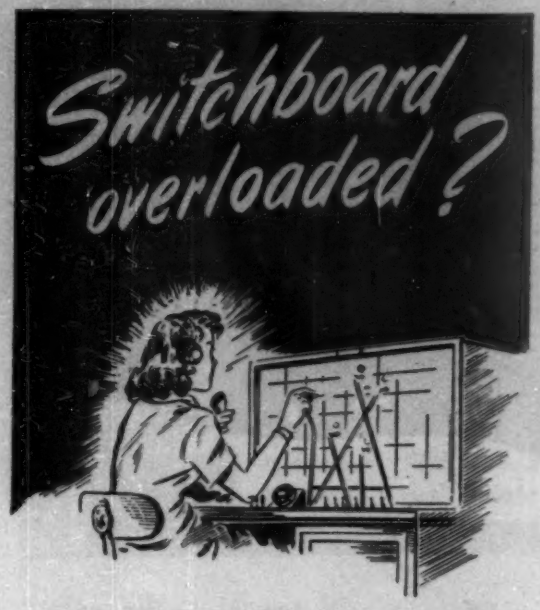
ABOVE—Type GP which, with type MT, are small, class A insulation transformers serving loads under 2 kva.

LEFT—Dry-type power center, used indoors as part of modern industrial distribution.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

"LEADERSHIP IN TRANSFORMER DEVELOPMENT . . . FOR EVERY POWER DISTRIBUTION JOB"



REDUCE THE LOAD ON BOARD AND OPERATOR WITH

WHEELER SELF-POWERED TELEPHONES

EFFICIENT TALKING AND RINGING UP TO 20 MILES

A pair of these compact, convenient telephone units quickly and inexpensively sets up auxiliary communication lines, *without batteries or power supply connections.* Use in plants, offices and other locations where immediate, efficient service saves time and money. Supplements PBX and intercom systems. See your jobber or write direct for descriptive booklet SA-8.

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MAGNET WIRE • COILS • BALLASTS

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Trend Indicators

Wage Hours

COST OF PENSION PLAN MAY NOT BE OFFSET AGAINST COST-OF-LIVING INCREASE

Where an employer granted a general wage increase of 5 cents per hour and a pension plan which amounted to a cost of 6 cents per hour per employee, he may only offset 5 cents and not 11 cents against the general wage increase justified by a rise in living costs since the execution of the last contract. The arbitration board pointed out that there is a clear distinction between an hourly wage rate increase and a company expenditure. "The former is immediately evidenced by increased pay; the latter, however valuable to the employees it may eventually prove to be, does not help currently to offset increased living costs." (In re arbitration between Los Angeles Transit Lines and Amalgamated Association of Street, Electric Railway & Motor Coach Employees of America)

HELD NOT EXEMPT

A city editor of a newspaper was held not to be an "executive employee" exempt under the Fair Labor Standards Act, since for more than 20 per cent of the hours worked by him in a work week, he engaged in work of the same nature as was performed by the non-exempt men under his supervision. Even though the non-exempt work engaged in by the editor consisted of copy reading, which was not of the same type of work as that performed by the men under his direction, he was still non-exempt, since "it is the nature of the work which is controlling and not whether any of the immediate subordinates of the employee in question was engaged in the same type of work." (Newspaper Guild v. Republican Publishing Company, USDC Mass.)

ACTION TO RECOVER DAMAGES NOT BARRED BY STATUTE OF LIMITATIONS

In an action to recover liquidated damages under the Public Contracts Act against an employer who hired child labor, the cause of the action is deemed to have accrued not on the date of such violation, but on the subsequent date of the Administrator's decision which was after the effective date of the Portal-to-Portal Act. Therefore, the court held that an action brought by the United States within two years after the decision is not barred by limitations under the Portal-to-Portal Act. (United States v. O. G. Harp; USDC W. Okla.)

FAIR LABOR STANDARDS ACT NOT APPLICABLE

An employee was held to be not covered by the Act where it was shown that his work was in no way connected with the process of production and where the employee failed to show that his services were so closely related to interstate commerce as to be a part of it, or that his employer or his employer's tenants were engaged in the production of goods for commerce. (Hamilton v. Bendix Storage Warehouse, NY Sup. Ct., Trial Term, Part VII, Kings County)

BASE DATE FOR COMPUTING COST-OF-LIVING INCREASE IS DATE OF LAST INCREASE

The base date for figuring a cost-of-living adjustment due employees whose contract has expired, should be the date on which wage rates were last negotiated by the parties and not the contract expiration date. The arbitrator rejected the company's contention that the last increase given was intended to compensate for the increase in the cost of living that occurred during the contract's life, since the rise in living costs during the life of the contract could not have been adequately foreseen when the contract was executed. (In re arbitration between Braniff Airways, Inc., and American Communications Association, Airline Communication Employees Association)

TERMINATED EMPLOYEES ENTITLED TO RETROACTIVE INCREASE

Where a wage increase was granted retroactive to the date of expiration of the prior contract, terminated employees who were on the payroll as of the retroactive date, and whose subsequent termination was not for cause, are entitled to the general wage increase. (In re arbitration between Braniff Airways, Inc., and American Communications Association, Airline Communications Employees Association)

(continued on page 222)

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TEAM UP Your Scrubber with a Cleanser that's *MADE* for It!

The greater speed of mechanical scrubbing requires the use of a cleanser that keeps pace with the speed of the machine. Cleansers designed for hand-scrubbing cannot be expected to give the fast cleaning action required for machine-scrubbing. In an attempt to get floors thoroughly clean, the operator of a scrubbing machine using a slow-acting cleanser may resort to prolonged brush action, but that needlessly piles up mileage on the machine, increases labor costs, and prematurely wears out the brushes.

To utilize the full cleaning capacity of your scrubbing machine—to get floors *film-free clean* in minimum time—choose a cleanser that's specially made for machine-scrubbing. *All Finnell Cleansers are.* And there's a type for every need, including *Setol,* the mineral oil solvent for cleaning oily wood floors, and *Finola, the Original Scouring Powder,* for heavy duty scrubbing of smooth, hard-surface floors.

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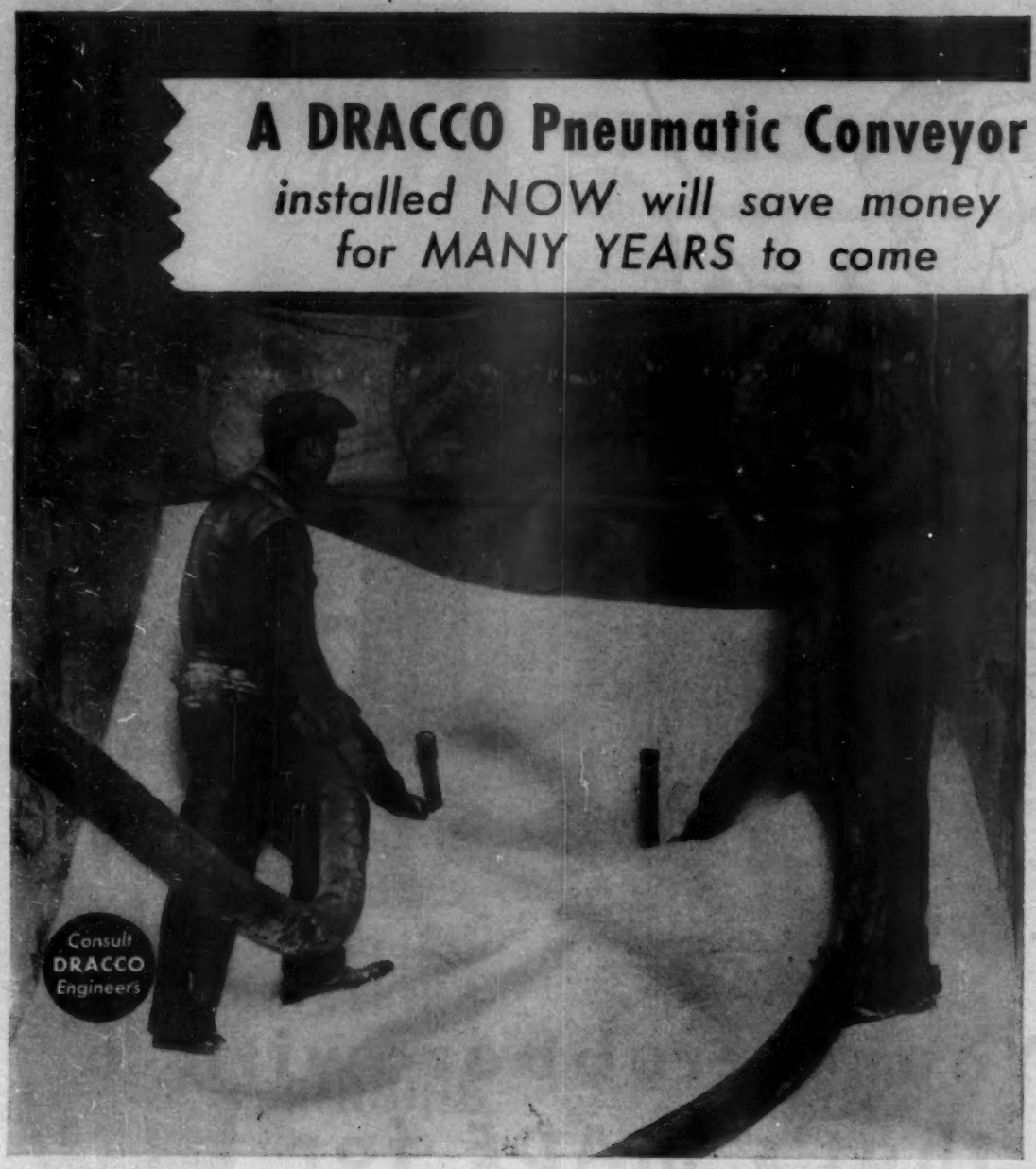

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Labor Management Relations

***MANAGEMENT PERMITTED TO CUT OUT OVERTIME**

Despite the fact that the contract contained a clause stating that "all provisions and conditions must remain the same as at present" an employer was justified in cutting out overtime for one group of employees, though the employees were receiving regular overtime work at the time the contract was signed. By rearranging the work schedule and eliminating the overtime, the employees involved still got the 48 hours a week guaranteed by the contract, and they lost only an extra that the contract did not guarantee them. The company defended its action by referring to the contract which authorized it to "relieve employees from duty because of lack of work or for proper cause." The arbitrator, in handing down his award, took cognizance of the company's defense and stated, "a general catch-all provision designed to freeze general working conditions cannot be construed to nullify an express provision of the contract." (In re arbitration between Valley Dolomite Corporation and International Union of Mine, Mill & Smelter Workers)

***MANAGEMENT PERMITTED TO SUBCONTRACT WORK**

Management was permitted to subcontract plant protection work and to transfer former guards to other jobs in the bargaining unit, since the contract contained no ban on subcontracting of work and the employer's action was not in bad faith or with an intent to harm the union. The company had announced that the purpose of the change was to bring about greater efficiency and economy in the plant. (In re arbitration between Ohmer Corporation and A. H. Ross Company, Inc., and United Electrical, Radio & Machine Workers of America)

***DISCHARGE UNJUSTIFIED**

Discharge of employees prior to the amended Act, in reliance upon the union security provisions of the contract, was unjustified, since the contract did not by its terms require membership in the contracting union as a condition of employment. In order for union security provisions to be relied upon as justification for discharges, they must be expressed in clear and unmistakable language. (Don Juan Company, Inc., and Don Juan, Inc., and United Packinghouse Workers of America, NLRB)

In the absence of a probationary

* In this classification, items marked with an asterisk also are considered to be trend indicators.

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LABOR DEVELOPMENTS *(continued)*

clause in the contract, an employer does not have the right to discharge employees for any cause within the first ten days of employment. (In re arbitration between Valley Dolomite Corporation and International Union of Mine, Mill & Smelter Workers)

An employer unjustifiably discharged an employee on the ground that he was carrying on a private business, since such a cause is not sufficient ground for discharge unless it interferes with the employee's obligations to his employer to an unreasonable degree. (In re arbitration between Consolidated Vultee Aircraft Corporation and International Association of Machinists)

***REFUSAL TO FURNISH INFORMATION HELD REFUSAL TO BARGAIN**

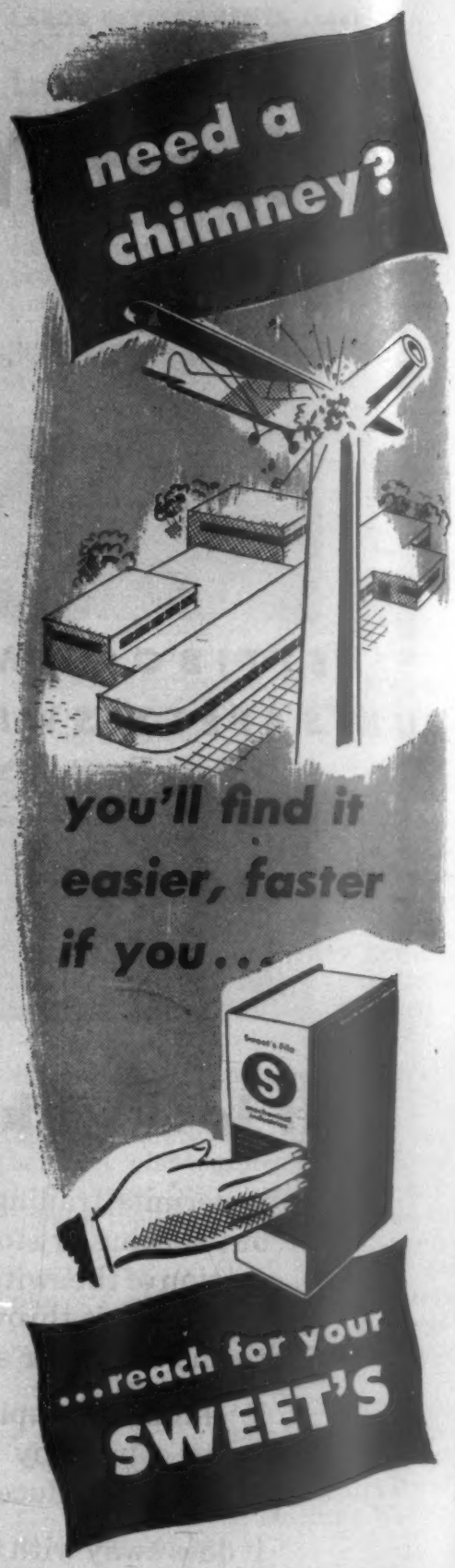
An employer was guilty of refusal to bargain where on several occasions, he refused to furnish the union with information he possessed relating to production requirements on government orders, methods used to calculate individual earnings, pay rates, and incentive bonuses, which information was necessary to the union in order that it might adequately represent the employees on the subject of wages. (Dixie Manufacturing Company, Inc., and Amalgamated Clothing Workers of America, NLRB)

***OBJECTION TO OFFERING COUNTER PROPOSALS HELD NO REFUSAL TO BARGAIN**

An employer was not guilty of refusing to bargain where it objected during negotiations to make its position clear by offering a written counterproposal embodying the terms and conditions of employment to which it would agree, since Section 8(d) of the amended Act provides that the duty to bargain collectively "does not compel either party to agree to a proposal or require the making of a concession." (Adler Metal Products Corporation and United Steelworkers of America, NLRB)

***REQUIRING OVERTIME WORK ON PENALTY OF DISCHARGE HELD INTERFERENCE**

An employer's action in requiring employees to work overtime on penalty of discharge in order to prevent them from being present at a scheduled union meeting, was held to be interference. The board rejected the employer's contention that two rush orders necessitated the overtime work, in view of the drastic penalty of discharge which the employer was imposing for inability or failure to comply with this last-minute overtime order, and the employer's subsequent delay in working on these jobs. (Kelco Corporation and United



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PHYSICAL CHARACTERISTICS

DENSITY . . . . . Approximately 11 lb. per cu. ft.

FLEXURAL STRENGTH . . . Approximately 50 lb. per sq. in.

COMPRESSIVE STRENGTH (at 5% deformation)
Before heating . . . . . 150 lb. per sq. in.
After heating for 24 hours at 1200° F. . . . . 117 lb. per sq. in.

LOSS IN WEIGHT
After boiling for 24 hours (after drying) 0.2%

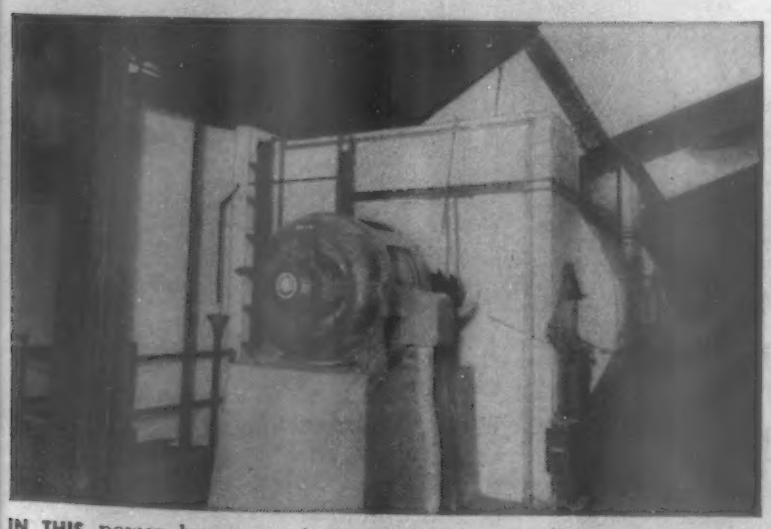
RESISTANCE TO ABRASION (Conventional tumbling test-loss in weight after 10 minutes)
After heating for 24 hours at 1200° F. . . 6.9%

DIMENSIONAL STABILITY
Linear shrinkage after heating for 24 hours at 1200° F. 1.5%

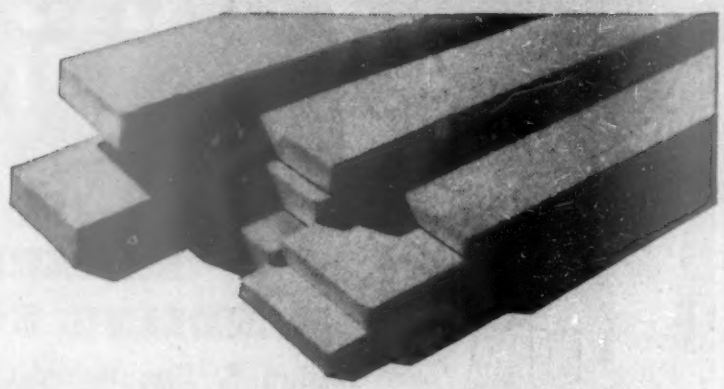
MOISTURE ABSORPTION (volume)
After 6 hours exposure in atmosphere of 120° F. and 90% Relative Humidity 0.9%

CONDUCTIVITY (K)
At 100° F. mean temperature 0.41
At 500° F. mean temperature 0.54

CLEAN, straight edges on these precipitator hoppers because they're insulated with Kaylo Heat Insulating Block. This material is easy to work with because it's easy to cut, yet has high flexural strength.



IN THIS power house equipment, Kaylo Heat Insulating Block covers both flat and curved surfaces. It minimizes heat loss, thereby saving fuel and keeping room temperatures at comfortable levels.



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KAYLO Heat Insulating Block (density: app. 11 lb. per cu. ft.) is now available for maintenance and new construction where a strong, lightweight insulation of high efficiency is needed.

Made in standard sizes (36 inches long, 6 or 12 inches wide and from one to three inches thick), it is efficient throughout the range of temperatures encountered in most plants. It has a "k" of approximately 0.48 at 300 mean and 0.54 at 500 mean; its curve is relatively flat. It can be used in temperatures up to 1200° F. Light in color, light in weight, smooth, strong, easy to handle and apply, it finishes to make clean-cut, good looking jobs requiring exceptionally low maintenance.

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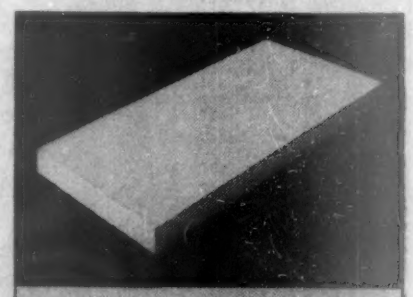
Kaylo Heat Insulating Block has been in pilot plant manufacture for several years, and many hundreds of thousands of square feet of it are now in use on typical heat insulating applications — in central power plants, chemical plants, textile mills, food processing plants, paper mills, steel mills, glass plants —on refinery equipment, ships, locomotives, annealing lehrs, high pressure boilers, hot air ducts, breachings and many other uses.

Now in production in a new manufacturing plant, Kaylo Heat Insulating Block is being shipped in quantity for the first time.



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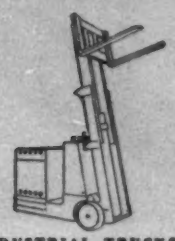
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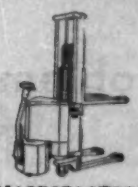
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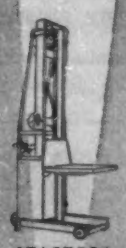
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Electrical, Radio & Machine Workers of America, NLRB)

***DISCHARGE TOO SEVERE A PENALTY**

Discharge was held to be too severe a penatly for an employee who, in an unexpected outburst, struck his foreman for criticizing his work, in view of the fact that for the past 25 years of service the employee had proved himself to be a reliable and peaceable worker. Although normally striking a foreman would be just cause for discharge, the extenuating circumstances in this case call for a lesser penalty. "An integral part of determining just cause are the full circumstances surrounding the violative act of an employee." (In re arbitration between Swift & Company and United Packinghouse Workers of America)

***DISCIPLINING WHOLE SHOP NOT JUSTIFIED**

An employer was not entitled to discipline the entire shop for engaging in a work stoppage where it could not be proved that all employees were guilty. While the arbitrator did find that some workers did quit their positions at the machines in protest over the employer's transfer of an employee, he pointed out that "in the absence of testimony as to their number and identity, it would be grossly unfair to the rest of the employees of the shop to penalize them for an action of which they were not proved to be guilty." (In re arbitration between S. Company, Inc., and United Electrical, Radio & Machine Workers of America)

***HOLIDAY PAY DUE EMPLOYEES ON LAYOFF**

Holiday pay was due employees for holidays which occurred during a layoff, where length of service was the only eligibility required for holiday pay. Although the company designated its action in closing the plant down as a "discharge," the arbitrator stated: "A mere label has no meaning unless that to which it is applied is generally recognized by the label. A person who enjoys the right to be recalled when plant operations are resumed is an employee of the company and enjoys the rights of an employee." (In re arbitration between Hudson Mohair Company and United Textile Workers of America)

***EMPLOYEES ABSENT ON STRIKING DAYS ENTITLED TO VACATION**

Under a contract which provides that employees will not be entitled to vacations if they are absent for 60 or more consecutive "working days," employees may not be deprived of vacations where they were absent for more than 60 days on striking days, since the term "working days"

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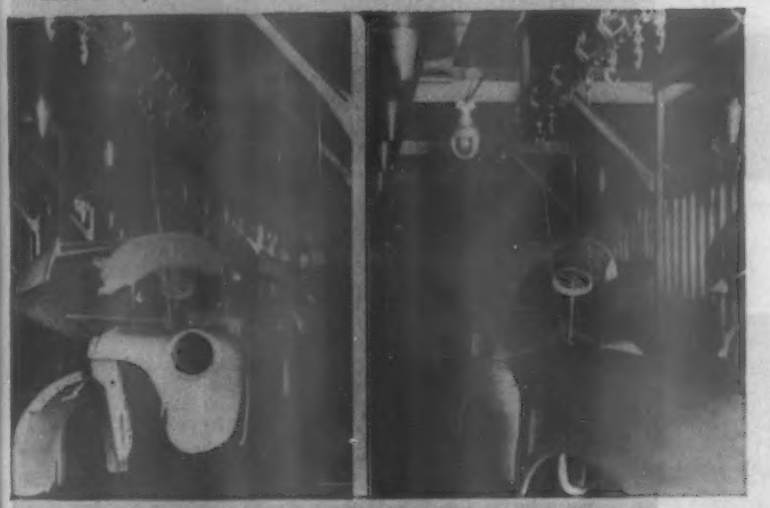
Above: View showing five Mahon Finish Baking Ovens Installed on the Roof of an Automobile Plant. Parts are Carried on Overhead Conveyors.



Interior of One of the Mahon Roof-Type Finish Baking Ovens Illustrated Above.

Body Finish Baking Ovens in the same Finishing System were Installed Inside of the Plant and Equipped with Automatic Swing Doors. Suction Intakes of the Recirculating Ducts are Located Over Door Openings to Minimize Heat Loss.

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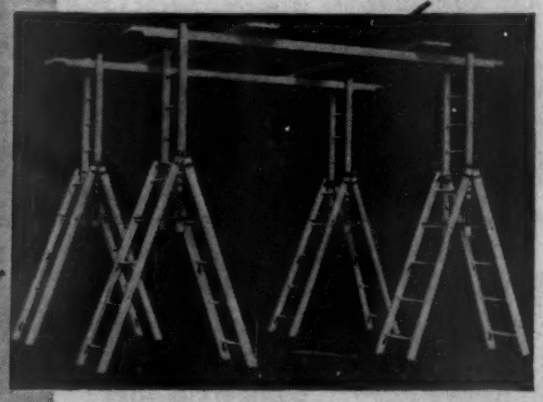

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does not include days spent on strike. Since in a prior arbitration award issued in 1946, it was stated by the arbitrator that "striking days and working days are the antithesis of each other, rather than synonymous," there cannot be any difference of opinion in interpreting the same language in the present contract. Said the arbitrator in the instant case: "If language previously ruled on by an arbitrator is to be changed, the change must come at the point of negotiations or else the decision fixes the meaning of that language for the future." (In re arbitration between Armour & Company and United Packinghouse Workers of America)

***VACATIONS DUE EMPLOYEES**

Vacations were improperly denied to employees who failed to work two-thirds of their respective vacation years (which was the contractual eligibility period) solely because the employer had discontinued production for three months and ten days in order to retool for an entirely new product. The arbitrator pointed out that if he were to sustain the company's position, "it would be tantamount to writing into this contract a provision that the employer may deprive his employees of all vacation rights by the simple expedient of shutting down his plants for an abnormal period of time." (In re arbitration between Fruehauf Trailer Company and United Automobile Workers of America)

***ARBITRATION NOT BARRED**

A union cannot be barred from arbitrating a dispute because it made errors in describing the dispute, since it was fully understood what the real dispute was, and the company knew what the party making the demand intended thereby. (In re arbitration between New Jersey Bell Telephone Company and Communications Workers of America)

***CONTRACT BENEFITS ENJOYED BY COVERED EMPLOYEES**

A contract providing for job-posting and promotion may not be construed to require an employer to offer employees covered by the contract an opportunity to move into non-covered jobs. Since plant clerical employees were not subject to contract coverage, the union cannot act as their bargaining agent or representative. "If it had been the intention of the parties to give the union the right to seek for its members promotions to jobs which are not covered by the union's contract, it should have been so specifically stated. To put such construction on the contract language by the arbitrator would, in his judgment, constitute an amplification of the contract." (In re arbi-

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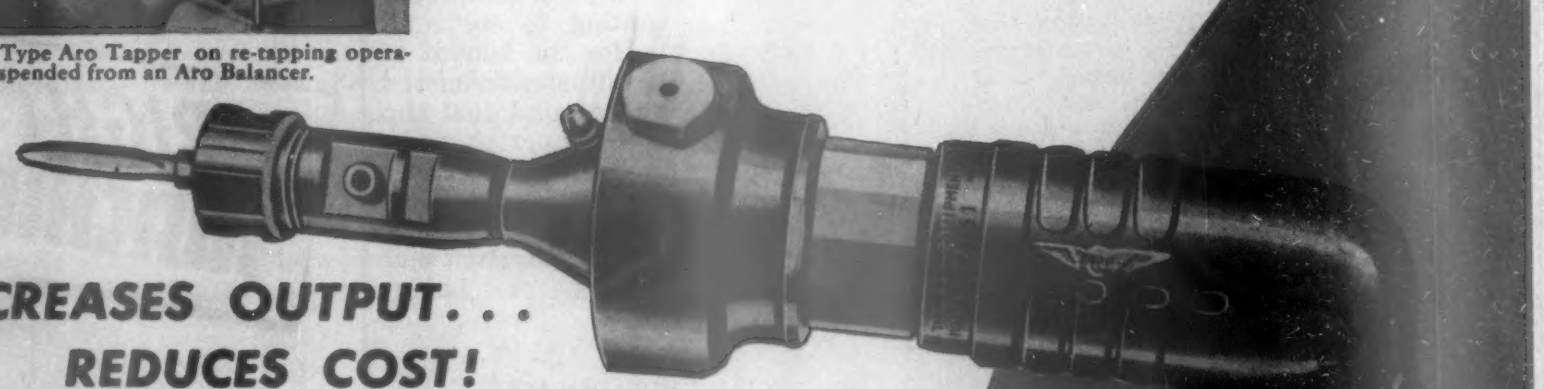
★ IDEAL FOR ALL TAPPING, RE-TAPPING



INCREASES OUTPUT... REDUCES COST!

Speed up tapping and re-tapping operations . . . cut down costs . . . with the new ARO Push-Pull Tappers! Automatically reversible —push for forward . . . pull for reverse. Twelve new models in wide speed range—450—750—1100—2500 r.p.m. Capacity 450 r.p.m. ¼" tap in ⅛" sheet steel. Re-tapping, chasing and cleaning up to ⅜".

Designed with *higher torque,* provided by a secondary planetary gear system supplementing Aro's famous "O" Series motor . . . *variable speeds* for maximum efficiency in an unlimited field of metals . . . *simplified tap changing and adjusting* by means of new type Jacobs tap chuck . . . *trouble-free reversing mechanism* . . . Aro-built dependability. See your Aro Jobber or send coupon for new bulletin.

ARO

AIR TOOLS

The Aro Equipment Corporation, 100 Trevitt St., Bryan, O.

Without obligation, send us your illustrated bulletin on the new Aro Push-Pull Tappers.

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Street.....

City.....State.....

Every shop needs a

SHOPLIFTER

● One man can safely handle heavy loads up to 500 pounds with the aid of an Economy SHOPLIFTER. It's the ideal lifter for handling dies and heavy shop equipment, for use as an adjustable work table, loading street trucks, stacking drums, boxes and many other products.

The SHOPLIFTER is made as compact as possible so that it can be used where space is at a premium. Clears ordinary doorways with ease, can be taken down narrow aisles and along side other machinery. Shop men like the Economy SHOPLIFTER because back-breaking manual lifting is eliminated, accidents are greatly reduced, and valuable production time is saved.

24 inch square steel plate platform has lift of 54 inches above floor. Overall height 72 inches, capacity 500 pounds. Price of complete machine $157.50 f.o.b. Chicago freight prepaid anywhere in the U.S. Foot operated floor lock $10.00 extra. Heavier lifter models also available, capacities up to 5000 pounds.

Write for details

ECONOMY ENGINEERING COMPANY
4513 W. Lake Street
CHICAGO 24, ILLINOIS

LABOR DEVELOPMENTS *(continued)*

tration between Brown Shoe Company and United Mine Workers of America)

***RECORD OF ABSENTEEISM HAS NO BEARING ON PROMOTIONS**

Where the contract states that promotions shall be governed by seniority where "ability and skill are relatively equal," an employer was unjustified in promoting a junior employee ahead of a senior employee on the basis of absenteeism and relative youth. The employer had no right to consider the record of tardiness when bypassing the senior employee, since the contract, in providing that ability and skill were the sole factors in determining whether or not seniority shall be determinative in promotions, did not allow for the consideration of attendance. (In re arbitration between Central Screw Company and United Steelworkers of America)

***INTERNATIONAL CANNOT REPRESENT NON-COMPLYING LOCAL BEFORE BOARD**

The board dismissed the petition of AFL where the local involved had refused to comply with Section 9 (f), (g), and (h) of the Act. The AFL stated that it reserved the right to bargain directly for the local union or in connection with it, since all contracts are subject to the examination and approval of AFL. The board, in finding that the international union was attempting to secure a board certification for the benefit of its non-complying affiliate, dismissed the petition on the ground that the local union was the proper party in interest to this proceeding and must therefore be in compliance with Section 9 (f), (g), and (h) of the Act. (Rub-R Engraving Company and American Federation of Labor, NLRB)

***MICHIGAN LABOR MEDIATION ACT HELD UNCONSTITUTIONAL**

The Michigan Supreme Court held as unconstitutional the section of the Michigan Labor Mediation Act which provided for compulsory arbitration of a labor dispute arising in any public utility, municipally owned utility, or hospital by an arbitration board of which a circuit judge shall be chairman. The court pointed to the fact that the Act conferred administrative and non-judicial powers and duties upon a judicial officer in violation of the provisions of the State Constitution preserving the principle of division of powers to state government. Said the court, "Important as industrial peace may be, particularly in the field of public utilities and hospitals, the absolute independence of the judiciary from executive or legislative control is of transcendent import." (Transport Workers Union v. Gadola, Mich. Sup. Ct.)

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- **MATERIALS**
- **MAN-HOURS**
- **MONEY**

with the . . .

RIGHT RIVETS

Select exactly the right semi-tubular, split rivet, or cold-headed fastener from Milford's complete line. You'll find it pays in every way!

RIGHT MACHINE

Then use the right rivet setting machine for your application. One of Milford's 15 basic machines is sure to solve your particular problem . . . and slash your production costs!

PENN RIVET & MACHINE COMPANY
254 Huntingdon Street
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CUT your COSTS

If you make or use boilers insulate with MONO-BLOCK!

Records show it! Today's buyers know it! In insulating boilers and processing equipment, you can make big savings on every job —using this one-block insulation that serves the full temperature range.

Savings in Material—Because Mono-Block is effective up to 1700 F., you eliminate the need for two types of block—make substantial savings in material alone.

Savings in Labor—Only one block to apply instead of handling a combination of blocks. B-H Mono-Block is light and resilient, cuts readily and fits snugly over rivet heads and other irregular surfaces.

Savings in Heat—B-H Mono-Block stops heat loss *with maximum efficiency*—because it's felted of long fibre *black* Rockwool. For example, conductivity of one inch thickness at 1000 F. is only 0.64 btu's per square foot per hour. Low alkalinity insures stability even under severe conditions.

Isn't it worth investigating? As a first step, send the coupon for a sample and descriptive literature.

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Specialists in Thermal Insulation

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Send free sample of Mono-Block and 24-page data book "Industrial Insulations."

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HEAT THAT COLD SPOT
Need quick heat for those troublesome cold spots? For chilly bench workers, small plant additions, drafty doorways? Install Trane Unit Heaters. Easy to buy — your jobber stocks them. Heat that cold spot — now!
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New Model H, the all-purpose unit heater
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UNIT HEATERS

THEY SAY AND DO

Steady Employment Programs Under Way

A growing nation-wide campaign to provide steady employment and pay for workers on a year-round basis was recently reported by National Association of Manufacturers.

Manufacturers operating in 64 cities have organized local employment stabilization committees to develop programs to make work regular, and thus protect the prosperity of their communities.

A series of employment stabilization clinics will be held this fall in the Middle West, South, and Southwest, on the problem of eliminating seasonal layoffs.

Worker Dismissed For Picketing

National Labor Relations Board recently ruled that engaging in mass picketing, even without violence, is enough reason for discharge. Dearborn Glass Company, Chicago, was upheld in its dismissal of a woman worker who joined massed pickets outside the plant. NLRB determined that mass picketing is not a protected union activity.

Employees May Buy Common Stock

Westinghouse Electric Corporation has registered 900,000 shares of common stock for purchase by employees with the Securities & Exchange Commission in Washington.

Through a payroll deduction plan, the stock will be offered to employees at $3 below the average market price in the month in which payment for the stock is completed. Each employee may purchase one share for each $200 of his annual wage or salary at the rate of $2 per month per share. Under the employee purchase plan, the maximum purchase price to employees will be $31 per share, while the minimum will be $25 per share, the approximate book value of the stock. Elected officers and directors of the company are excluded from the plan. The plan permits employees to cancel their purchases and have their money refunded at any time up to the tenth day of the month after payments are completed. A prospectus has been mailed to each of the company's 105,000 employees.

$150,000 Grant for Metallurgical Research

A $150,000 contribution to the University of Chicago's basic research program has been made by the Crane Company. The contribution covers both a 5-year industrial membership in the University's Institute of Metals and a fellowship in the Institute for Nuclear Studies.

A spokesman for the Crane Company pointed out that the limitations imposed upon metals by temperature, stress, and corrosion are the principal deterrents to greater progress in many industries. Basic metallurgical research is needed to expand fundamental knowledge of the metallic state, and thereby make it possible for applied research to develop new and improved metals.

Supervisor's Role Industrial Relations

GLENN GARDINER, Vice-President, Forstmann Woolen Company, speaking before the Conference on Personnel of the American Management Association.

Unless we can instill in our supervisers a high degree of human-relation-consciousness, no extravagant set-up of personnel activities can hope to build sound industrial relations. Unless the supervisor is the embodiment of fairness and consideration for workers. A pronouncement of fair practice policies by top management, and by personnel departments, merely gives the worker the impression of insincerity. "If the company believes in fair play," the worker says, "then why doesn't it give me a boss who practices fair play?"

It does not help the supervisor on the job very much if the worker feels that "the personnel man is bighearted, but I can never get anything out of my own boss."

An industrial relations program should be designed so that it functions through the supervisory organization rather than over the heads of supervisors. Our purpose should be to select and train supervisors so that they are the ones to whom workers turn. This reliance upon supervisors for the discharge of personnel functions calls for an enlightened supervisory organization. And so it is in the enlightenment of the supervisory organization that our personnel departments can play their most important part.

Work Injuries Lower in Second Quarter of 1948

Work injuries in manufacturing industries declined during the second quarter of 1948, not only in absolute number, but also in the rate per million man-hours worked, according to reports received by the Bureau of Labor Statistics of the U. S. Department of Labor.

The slight seasonal upswing in the injury-frequency rate noted in the first quarter was reversed and the general trend downward was re-

Write for this Catalog *TODAY* on the new

Multi-Outlet Wired Strip

that gives you a

S-P-R-E-A-D

OF OUTLETS

You'll find in this booklet:

1. How easily PLUG-IN STRIP is installed.
2. A complete illustrated catalog-chart of all the parts and fittings required for any job.
3. Instructions on the use of LOPO-TRIM—the metal quarter-round for housing telephone and other low-potential wiring.
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National Electric Products Corporation

Pittsburgh 30, Pa.

National Electric Products Corporation
1310 Chamber of Commerce Building
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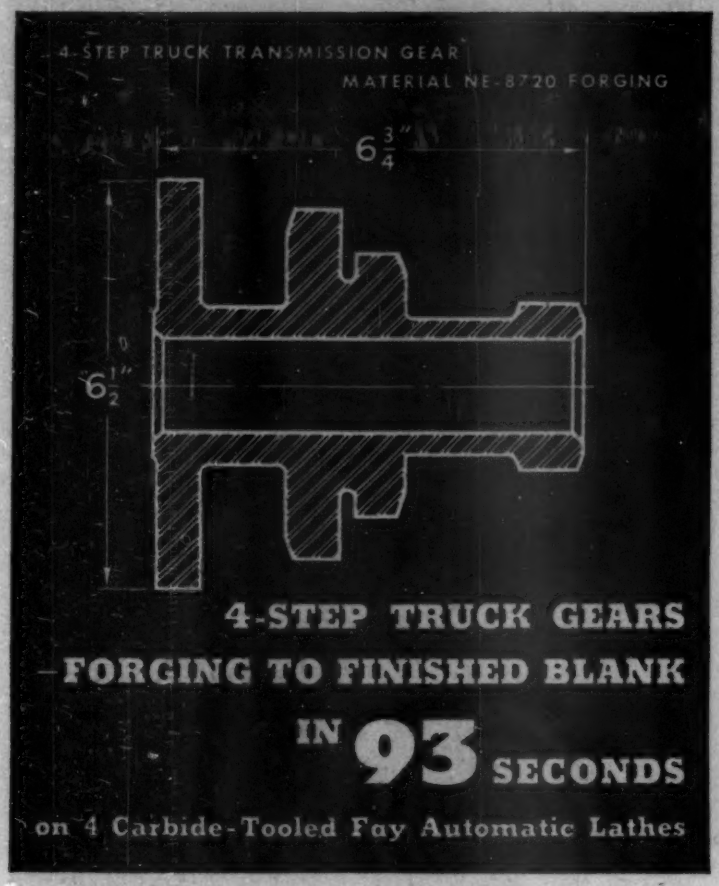
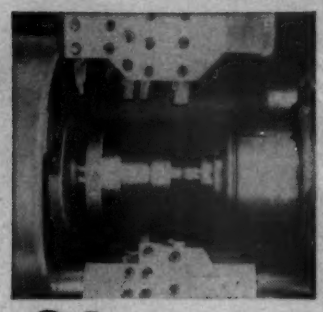
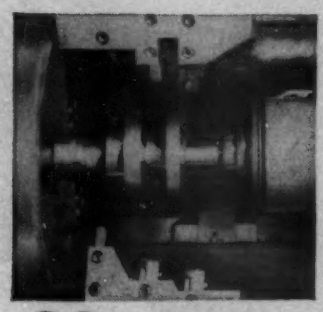
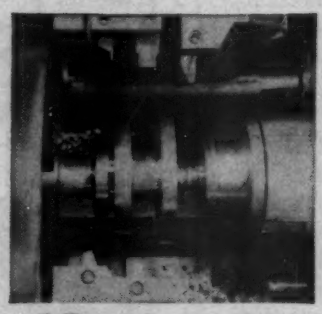




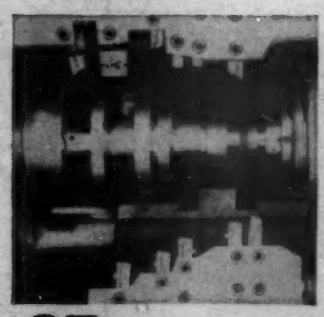
24 SECONDS
1st operation



28 SECONDS
2nd operation



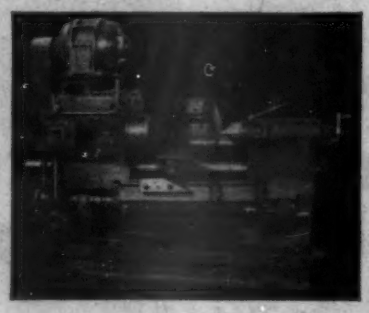
18 SECONDS
3rd operation



23 SECONDS
4th operation

This 4-operation gear job is a striking example of production turning on the Fay Automatic Lathe. Every tool has either a brazed or an insert-type carbide tip. Approximately 68 HP is transmitted during the first operation! Surface speeds range from 450 to 660 FPM. The blanks are completely turned, faced, formed and grooved, with every important surface held true and concentric . . . Moreover, these 4 machines are doing the work formerly done by 17!

Why not write us for more details? Let us show you why it's cheaper to own a Fay than to compete against one!



Our new 16" Fay Catalog contains many other examples of high production turning. Write to Dept. 710F for your copy.

DESIGNED To lower every turning cost. ***BUILT*** For maximum production with either carbide or high speed steel tools. ***POWERED*** To produce more chips per tool, more pieces per hour, more profit per job . . . than any automatic lathe of comparable range.

Fay Lathe Division

JONES & LAMSON MACHINE COMPANY
Springfield, Vermont, U.S.A.

MACHINE TOOL CRAFTSMEN SINCE 1835

sumed. From a rate of 14.5 disabling work injuries per million employee-hours worked in March, 1948, the all-manufacturing injury-frequency rate decreased to 13.9 in April, 13.5 in May, and 13.2 in June.

This decline was partially seasonal. May and June typically showed lower rates than those reported during the first quarter of the same year; however, April has usually been a month of higher rates. The general downward trend is apparent from a comparison of the average rate of 13.5 for the entire second quarter of 1948, with a rate of 15.7 for the second quarter of 1947, and 18.1 for 1946.

Course in Screw Machine Technology Established

The Rochester Institute of Technology has recently offered, for high school graduates in good standing, a three-year cooperative course in the field of screw machine technology.

The program was established with considerable help from the National Screw Machine Products Association and other manufacturers interested in the screw machine industry. To date, two $1500 scholarships have been awarded.

Workers Censured on Output Record

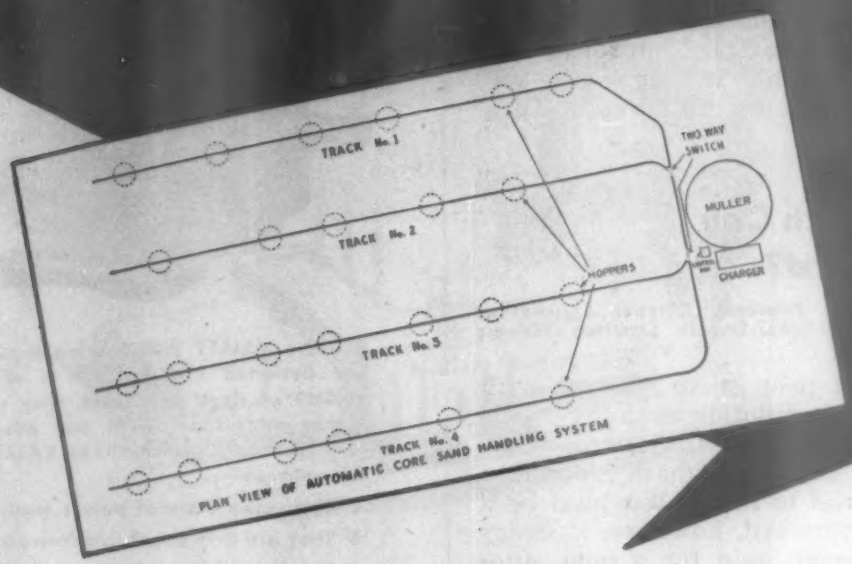
At a recent American Management Association parley, agreement was reached by Frank Rising, general manager of the Automotive & Aviation Parts Manufacturers Association, Dr. Leo Wolman, National Bureau of Economic Research, and John S. Bugas, vice-president and industrial relations manager, Ford Motor Company, to the effect that despite three rounds of wage increases since the end of the war, employees have failed to increase in industrial productivity to any appreciable extent by putting forth greater effort. Rising stated that union leaders have held employee productivity to a minimum by reducing work standards "to the silly point."

"One case," he said, "comes from a large automotive parts plant where the production of an item had been assailed by the union stewards as being too high and had sunk from the early post-war figure of around 20,000 a day to about 14,000. After some months at this rate, the company warned the stewards to stay out of that department on penalty of discipline. The production moved up with no addition to the working force, from 14,000 to 38,000."

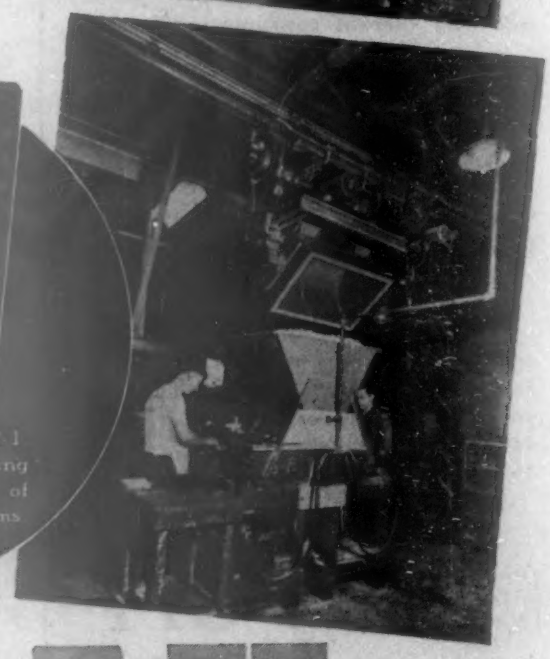
Dr. Wolman cited government statistics indicating that between the last six months of 1945 and the first six months of the current year, numbers of civilian employees had increased by 12 per cent with earnings

Automatic Dispatch System

delivers 25 tons of core sand per day!



PLAN VIEW OF AUTOMATIC CORE SAND HANDLING SYSTEM



This compact system requires only two men to keep 24 core benches supplied with fresh core sand. Charger receives sand from underground conveyor. Sand is loaded and automatically dispatched and dumped to any one of 24 stations, on four tracks, by push button control. Track switches are manually operated. Each track can be increased to 16 stations or 64 in all. This is another of the hundreds of American MonoRail installations that have cut handling costs. Let an American MonoRail engineer show you how it can be done in your business.

THE AMERICAN MONORAIL COMPANY

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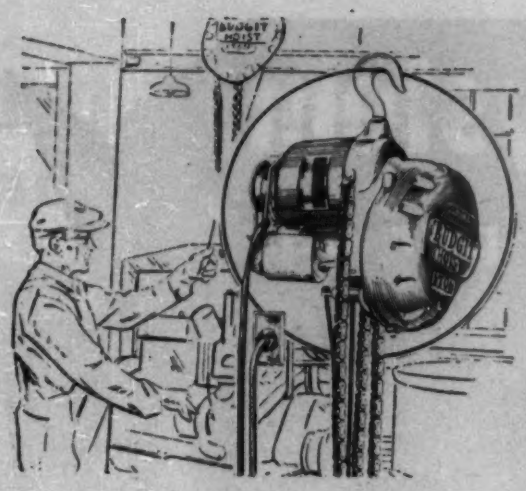

Sure Profits!

The savings made by 'Budgit' Hoists show up the first hour they start to work for you — and continue to show up every working hour through their long, trouble-free lives.

Work on production, assembly and inspection lines goes so much faster — it's like adding extra minutes to every hour. This is doubly important when production costs are so high.

Workers like 'Budgit' Hoists. They make their jobs so much easier and eliminate the danger of sprained backs, rupture or over-fatigue due to the lifting of heavy loads.

A 'Budgit' quickly pays for itself and then keeps on earning extra profits. There are no installation costs. Hang up, plug in, use! That's all! The current consumption is too small to consider.

Prove what a 'Budgit' Hoist can do for you by installing one now at any spot in your plant where the lifting of loads slows up production.

Made in sizes to lift 250, 500, 1000, 2000 and 4000 lbs. Prices start at $119. Write for Bulletin No. 371.

MAXWELL MANNING & MOORE M&M TRADE MARK

'BUDGIT' *Hoists*

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Builders of 'Shaw-Box' Cranes, 'Budgit' and 'Load Lifter' Hoists and other lifting specialties. Makers of Ashcroft Gauges, Hancock Valves, Consolidated Safety and Relief Valves and 'American' industrial instruments.

up from 35 to 40 per cent, while factory output rose by 9 per cent. In view of this evidence, he stated: "It is hard to see how anyone can question the conclusion that the great rise in wages since 1939 has not been accompanied by much of an increase in employee efficiency."

Bugas pointed out that management technological improvements, rather than harder work by employees, has led to greater productivity.

How Much Can We Afford?

E. T. KELLER, President, Chrysler Corporation, speaking before the Seventh Stamford Business Conference

I do not propose to quarrel with our voting population as to the public services they think they need. This, too, is a sort of climatic condition business has to meet. It would be a fine step forward, however, if every time a person paid for a new automobile he should go through a mental process like this:

"Now, I am going to buy my automobile, so let's see what I must pay. The car itself seems to cost about $1600, but I am not allowed to drive it away unless I first pay off—

"So much for interest on the war debt; so much for the Army and Navy and Air Force; so much for old age pensions.

"So much for the Indians; so much to dredge the rivers of the country; so much for unemployment insurance in Ohio, Pennsylvania, and quite a few other states, including my own.

"So much for public health; so much for the Merchant Marine; so much for the highways I shall use; so much for local police and fire departments, and sewers.

"So much to support the price of eggs; so much for atomic research; so much to support inefficient producers; so much for relief abroad, and so much for relief in my own country.

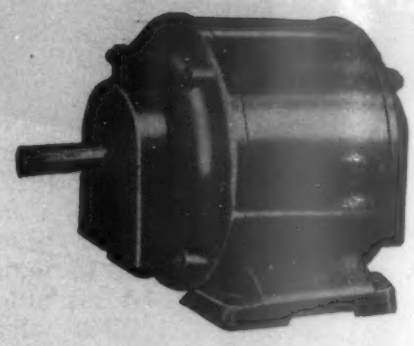
"So much for the cost of collecting all these taxes, and so much more to pay salaries of a lot of other people on the public payroll (and the Lord only knows what all of them do)."

Now, the tax purposes I have listed are neither worse nor better than many, many others, and I am not discussing their merits. All of them reach in to take their dollars or dimes or pennies or mills, out of the transaction which arises because John Citizen, voter and taxpayer, decides he needs a new car to make his goings and comings more convenient.

Materials Handling Show Set for January

The Third National Materials Handling Show will be held at Convention Hall, Philadelphia, January

This **MOTOR** *is holding down thousands of* **JOBS—**



Because VALLEY Ball Bearing Motors are designed and built in a wide variety of sizes and types, they are highly adaptable to fit any power requirement. Check these VALLEY advantages—

- **They take unusual power loads**
- **They are Drip proof... splash proof**
- **Economical**
- **Cool**
- **Ball Bearing**

Look to VALLEY for dependable power Units.

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Your property, your equipment, are protected against thieves, meddlers, and the curious when Pittsburgh Chain Link Fence is on the job. Also the coming and going of your own employes is regulated which in itself can save you money both in time and material. We have been planning and erecting good fence for many years—our experts will be glad to give you advice and a cost estimate. Write to Pittsburgh Steel Co., 3251 Grant Building, Pittsburgh 30, Pa.

PITTSBURGH STEEL COMPANY

No Limit to the uses for HANSEN COUPLINGS

NEEDED IN EVERY FLUID LINE

Economies are created in every plant by the use of HANSEN couplings in fluid lines. The quick-connective and shut-off features of these couplings save you time and money, and the variety of jobs they do is endless.

HANSEN couplings make connections and change-overs a matter of seconds. Costly operations are not interrupted . . . equipment continues to produce. Connection is made by pushing plug into socket . . . flow starts at once, automatically. Slight movement of the socket sleeve releases plug, and supply line is immediately sealed . . . one-way or two-way shut-off. For applications where no closure is desired, a "straight through" series has been designed. Each HANSEN coupling is engineered for the service for which it is recommended, and there is no limit to the uses for HANSEN couplings in these services.

Write for Industrial Catalog No. 47

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Dressings that LUMP UP on belts and pulleys actually stretch the belts. Try DIXON'S and you'll never use another dressing.
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SOLD BY SUPPLY HOUSES EVERYWHERE
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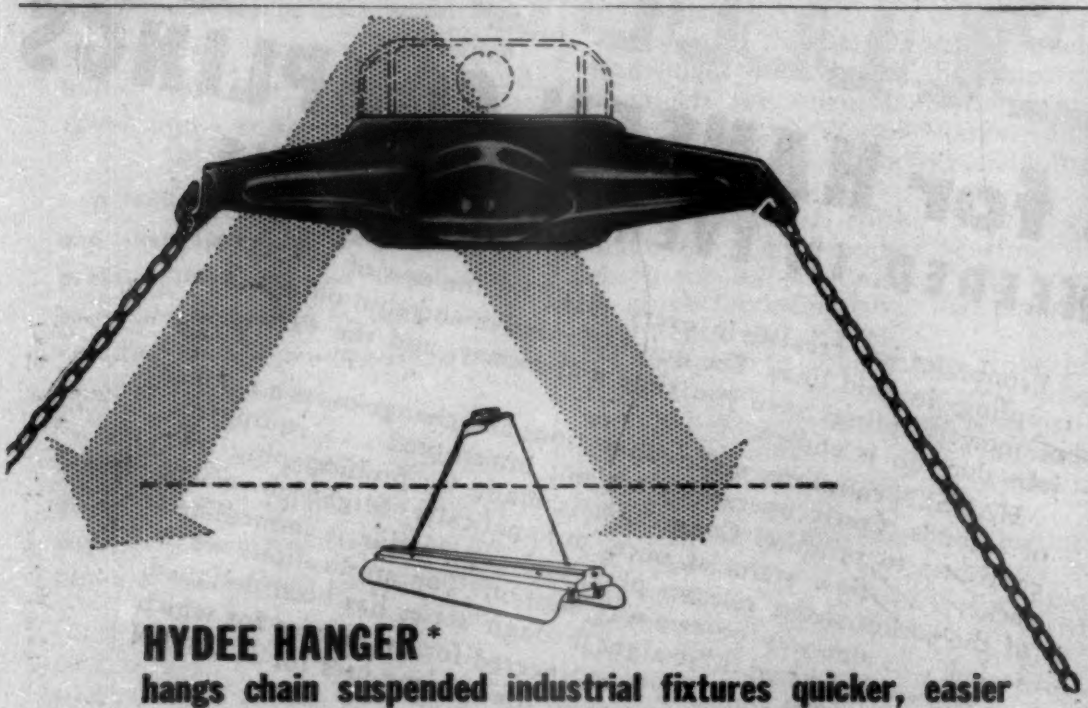

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hangs chain suspended industrial fixtures quicker, easier

A screwdriver is all you need . . . for new or "change-over" jobs. Fits standard 4" or 3¼" outlet box or plaster ring. Self-grounding . . . you can use 2-wire cord and plug. **Complete** with receptacle, two 5-foot chains, spring wire "S" hooks and cord clips.

$1.65 LIST

Day-Brite Lighting, Inc., 5441 Bulwer Ave., St. Louis 7, Mo.
Nationally distributed through leading electrical supply houses.
In Canada: address all inquiries to Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

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IT'S EASY TO SEE WHEN IT'S DAY-BRITE Lighting

*Patent No. D-141024 and No. 440914
Underwriters approved.

10-14, 1949. The exposition is devoted to various systems of handling materials in production and shipment.

The show will be one of the five largest annual industrial expositions to be held in this country. One hundred and ninety-two companies have leased 96,725 square feet of net exhibit space, and the remaining 16,000 feet are expected to be occupied when the show opens.

This year the show will be jointly sponsored by the Management and Materials Handling Divisions of the American Society of Mechanical Engineers and the Material Handling Institute. The ASME groups will conduct a 5-day conference on materials handling concurrently with the exposition. A materials handling theater will exhibit late films on handling subjects.

Emphasis both in exhibits and in conference talks will be placed on the need for greater efficiency in handling to reduce production and distribution costs, and the greater use of existing facilities for storage.

Admission to exhibits and the conference will be by registration. No charge will be made.

Among the many types of equipment to be exhibited will be hand trucks, lift trucks, conveyors, hoists, monorails, portable elevators, stacking units, cranes, tractors, trailers, fork trucks, skids and pallets, and their respective accessories.

Advance registration cards may be obtained from Clapp & Poliak, Inc., 350 Fifth Avenue, New York 1. Hotel reservations may be obtained through the Secretary, Housing Bureau, Materials Handling Show, 17th and Sansome, Philadelphia 3.

Paper Pallet Undergoes Test

A new type of paper pallet was recently given a severe test by the Bristol-Myers Company, New York. For purposes of the test, cartons of a hand lotion produced by the company were used. The lotion is packed three dozen bottles to a carton, and each carton weighs about 30 pounds. Under the previous handling system each carton was handled individually at the plant, where it was loaded on trucks; at the pier in New York, where it was taken aboard a vessel carton by carton; on the ship, where it was stowed in the hold; and, on the West Coast end, where it was unloaded, again placed on trucks, sent to a warehouse, again unloaded and stacked, all by individual cartons.

The initial shipment in the test consisted of some 24 pallet loads, each pallet containing 64 cartons, the weight running to a little less than 2000 pounds each.

The pallet used was 40x48 inches, weighing only 6 pounds as compared with 100 pounds for wooden pallets. The paper pallet is capable of sup-

COAL HANDLING

With an almost unlimited assortment of material handling machinery, Jeffrey can show you savings in the ultimate cost of coal, whether your plant is large or small. Yes, LCPTH means 'Lower Cost Per Ton Handled' if handled the Jeffrey way. Every conveyor and accessory device to do the job right . . . and dispose of ash residue, too.

CATALOG NO. 778-A

Skip Hoists, Bucket Elevators, Belt Conveyors, Spiral Conveyors, Steel Apron Conveyors (see photo) . . . also chains, weigh larries, chutes, valves, sprockets, drag chain and scraper conveyors.

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This operator *knows* that her work will pass inspection. With the aid of a Spencer *Stereoscopic* Shop Microscope she sees smaller details and controls her operation more accurately. The result is less scrap; lowered costs; increased profits.

Designed to meet critical wartime requirements, the Spencer Shop Microscope offers manufacturers new possibilities for quality control at every point—inspection of raw materials, toolmaking, tool inspection during operation, fine machining, and final inspection. Equipped with or without standard base, it is adaptable and can be permanently mounted to your equipment. Choice of optics offers magnifications from 9X to 54X.

For further information write Dept. E156.

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COMPANY
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Buffalo 15, New York

Manufacturers of the SPENCER *Scientific Instruments*

porting as much weight as can be carried by the usual pallet handling equipment—i.e. average fork trucks. Pallets capitalize on the inherent vertical strength of a cylinder and consist of a flat sheet of corrugated paperboard, supported by 9 spiral-wound paperboard tubes. Approximately 5 inches in diameter, these tubes are secured to the platform with a special adhesive and treated to make them moisture proof.

In the test, cartons of hand lotion were stacked at the plant on pallets, there they were loaded on trucks by means of fork trucks. Trucks delivered the merchandise to the pier where it was unloaded, checked, and loaded into the hold, still on pallets. At the other end, the pallets were removed, loaded on trucks, sent to the warehouse and unloaded.

Savings at All Points

A spokesman for the company pointed out that there is a considerable saving in man-hours not only loading at the plant, but in all phases of the transportation and storage, since each pallet loaded was handled entirely by mechanical equipment, whereas under the old system, each carton would have been handled individually at every stage of the movement. Since the loads remain palletized throughout the journey, economies occurred all along the line. In addition, worker safety was increased and fatigue lessened. Damage to merchandise and repacking were practically eliminated, checking time was cut, and payments for detention of trucks, a frequent charge sustained when individual cartons have to be loaded, stored in the truck, and unloaded, was eliminated. The cooperating steamship line is also believed to have made substantial savings because of the cutting down in the number of man-hours needed for loading, storing, and transferring merchandise to shipside for loading. The ship line found, as had the shipper and trucking company, that damage and pilferage were practically eliminated.

The low cost and light weight of the pallet were of paramount importance, since pallets shipped under load by highway truck and railway freight car take the same freight rate as the commodity being carried, and return of empty pallets to the owner entails added freight charges. The disposable pallets may be used, of course, in other truck shipments.

In estimates of the savings per man-hour made, the company reported that one-fifth of the time was required for handling the palletized goods at the plant, as was required for unpalletized goods. About 20 per cent was saved in direct charges for transportation of the palletized merchandise. The steamship company made a saving of 80 per cent in the

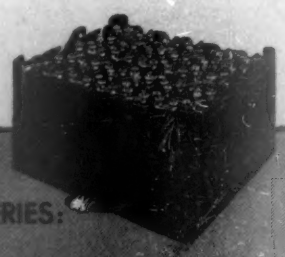
UP goes material-handling efficiency

when you use Battery Industrial Trucks

Greater efficiency in material handling means greater earning power in any plant. Start paring unnecessary moves for production hands or warehouse men and you not only reduce handling cost per unit, but make way for volume never before possible.

Battery industrial trucks are the dependable, economic means of obtaining such efficiency. They can perform their strenuous tasks 24 hours a day every day if required, and their power characteristics are outstanding: instant starting; quiet operation; no fumes; no power used during stops. Driven by electric motors, they have a minimum of wearing parts and are inherently trouble-free.

Keeping these hard-working trucks on the job calls for EDISON Nickel-Iron-Alkaline Batteries. Built of rugged steel, yet precise as a watch, they are recognized for dependability, long life and trouble-free operation. Specify EDISON and you specify maximum reliability—enduring quality.



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STORAGE BATTERIES

ADVANTAGES OF EDISON NICKEL-IRON-ALKALINE BATTERIES:

They are durable mechanically; can be charged rapidly; withstand temperature extremes; are foolproof electrically; can stand idle indefinitely without injury; are simple and easy to maintain.

EDISON STORAGE BATTERY DIVISION OF THOMAS A. EDISON, INC., WEST ORANGE, N. J.
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Present Day Practice in Belt Fastening

Every man who has anything to do with the purchase, application or maintenance of conveyor, transmission or V-belts will find the bulletins listed below of considerable value in connection with belt fastening work. A knowledge of present day practice in belt fastening helps reduce the loss in machine hours due to belt failures caused by the use of the wrong type of fastener or improper application. We shall be glad to send any or all of them to you or to any of the men in your organization.

For Conveyor Belts

FLEXCO HD Belt Fasteners are used to make a "water-tight" butt joint in conveyor belts ranging from ¼" to 1½" thick and of any width. The view on the right shows the various types of rips that can be repaired with these fasteners and Flexco HD Rip Plates.

Bulletin F-100 gives complete details on how to fasten and repair conveyor belts.

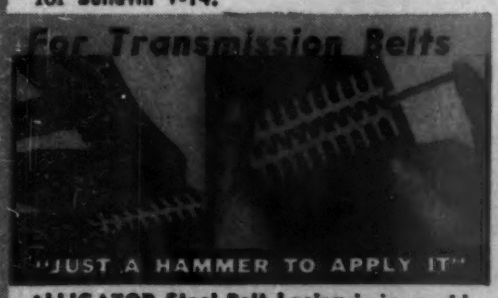
For V-Belts

ALLIGATOR V-Belt Fasteners are now being widely used to fasten B, C and D, open-end V-belting of cross woven fabric core construction now being made by most belting manufacturers. The view at the left shows a typical application of these fasteners to a drive where endless V-belts would require dismantling the machinery to put the belts on the sheaves.

Bulletin V-205 gives complete instructions on how to use V-belt fasteners.

FLEX V Fasteners for A and B belts are also available for lighter duty V-belt drives. Ask for **Bulletin V-14.**

For Transmission Belts



ALLIGATOR Steel Belt Lacing is in world-wide use to make smooth, flexible joints in leather, rubber, balata, stitched canvas or solid woven belts up to ⅛" thick and as wide as they come.

Bulletin A-60 tells how to fasten and repair transmission belts.

Sold by Supply Houses Everywhere

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4678 Lexington St., Chicago 44, Ill.

amount of man-hours needed for truck unloading, storing, and transfer of merchandise to shipside for loading. Another saving of 50 per cent in man-hours of handling was made for ship loading operations. The unloading, storing, and transfer of the shipment on the West Coast paralleled the same savings that had been made at the New York pier.

Cost-of-Living Plan Long Used in Australia

McGraw-Hill World News, Melbourne

The General Motors pay plan has hardly caused a ripple of discussion in labor-troubled Australia. A similar plan, in a different frame, has been operating down under for 40 years. Whether because of weaknesses in the plan itself or because of the Australian modifications, it has not worked too well.

The GM plan ties pay to a "cost-of-living" index and provides for automatic increases with technological advances.

Australian workers are supposed to be paid on that basis. The difference is that individual Australian firms do not have a bargaining table at which come to terms with labor. Bargaining is replaced by government arbitration with industry-wide and state-wide application.

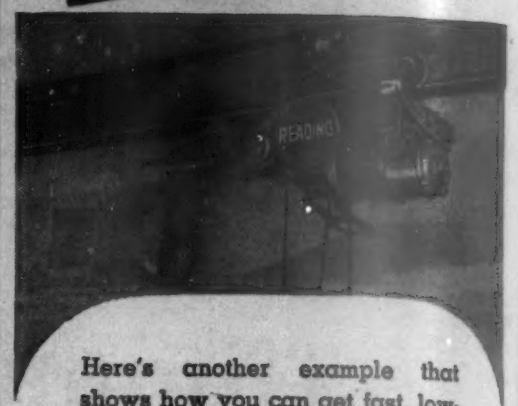
The arbitration courts are mainly concerned with establishing the basic wage. This wage has no relation to the value of the service which the particular employee renders to his employer, but is based on industry's ability to pay. Specially qualified workers receive, on top of the basic wage, additional payments known as margins. There are other margins, as for very dirty work.

In the intervals between the general revision of the basic wage, the real value of the wage is kept as stable as possible by quarterly adjustments based on retail price index figures. Likewise, through regional cost-of-living adjustments, the employees' purchasing power is kept uniform irrespective of location.

While the pay envelope adjusts itself to changes in the cost of living, workers do not automatically share in higher profits when advancing technology bumps up efficiency. It is left to the court to decide whether a given industry or the economy as a whole can bear a higher labor remuneration. The last significant concession to technology was made by the Federal Arbitration Court last year when it decreed reduction of the working week from 44 hours to 40, without reduction in pay.

The retail price index, as a basis for calculation of the cost of living (and, therewith, of the basic wage), has come under fire from both employers and employees. To the employees, the index does not appear to reflect the true cost of living in

HOW ONE PLANT *Streamlines* MATERIAL HANDLING



Here's another example that shows how you can get fast, low-cost materials handling, right now. Before installing a *Reading* engineered system, this plant had to wheel heavy barrels to the mill via hand trucks. To streamline the operation, *Reading* Engineers were called in. A one-ton Reading Electric Hoist, operating on a built-in parallel trolley, was recommended. Now barrels move faster—less manpower is tied up—and the entire operation costs far less!

Let Reading Engineers give you *practical* suggestions that can streamline your handling operations. Drop us a line for full details. No obligation, of course.

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OVERHEAD TRAVELING CRANES

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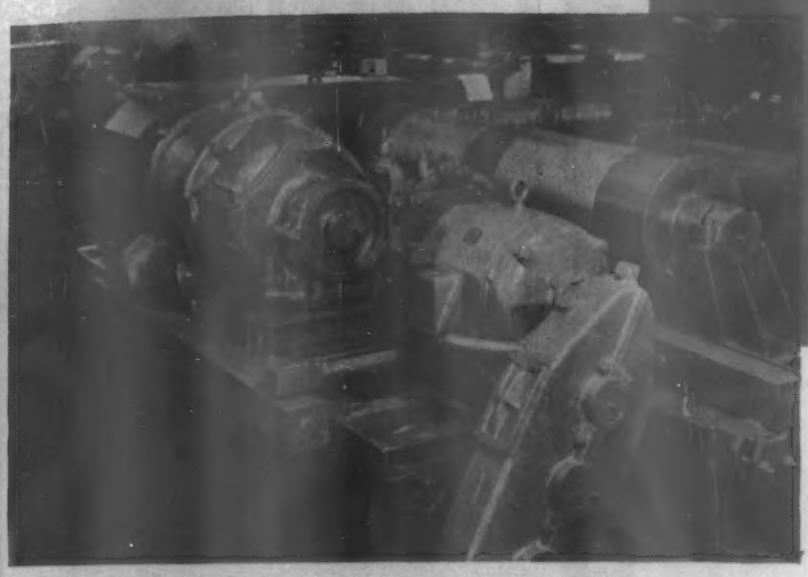
Century SLIP RING MOTORS

Supply High Torque AND Smooth Acceleration for Applications Requiring...



● 40 horsepower Century Slip Ring motor drives crane hoist and 5 horsepower Slip Ring motor drives crane travel.

● 10 horsepower Century Slip Ring motor supplies flexible power for a printing press.

● 75 horsepower Century Slip Ring motor driving wire plant machine.

Adjustable Varying Speeds
Torque Control
Low Starting Current

Century Slip Ring motors provide flexibility of torque and speed to match varying load requirements of the machines they drive.

Typical applications for these motors are: cranes, hoists, bending rolls, printing presses, wire mills, bridges, mitergates, locks, dams, conveyors, elevators, reciprocating pumps, and other high impact and inertia loads.

If you have machines that require variable speeds or torques — as well as low starting current — specify Century Slip Ring motors.

Century builds a complete line of electric motors, in sizes from 1/6 to 400 horsepower for all popular electric power applications.

Specify Century motors for all your electric power requirements.

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1. Quality — Champion **Fluorescent** Tubes and *Incandescent* Bulbs are guaranteed to equal or exceed Federal Specifications. They are produced, inspected and tested by one of the largest and best-equipped manufacturers in the business — makers of dependable lamps for industrial service for nearly fifty years.

2. Range — Champion **Fluorescent** — daylight and white, for regular circuits, instant start circuits and low temperature service. Champion *Incandescent* — clear, inside frost, white bowl, silvered bowl bulbs, for general lighting service, spotlight, floodlight, reflector lamps and infra-red lamps.

3. Service — Champion's trained experts in the field are prepared to provide prompt, dependable recommendations on lighting and lamp applications to meet every industrial need.

4. Economy — Low overhead and streamlined distribution assures minimum lamp and lighting cost.

5. Availability — through carefully selected industrial distributors who know your needs and provide prompt, intelligent, low cost supply service.

May we put you in touch with the Champion industrial distributor in your locality?

CHAMPION LAMP WORKS
Lynn, Massachusetts
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO

times of rapid price advances. And employers object to its use because retail prices usually lag far behind wholesale prices when the whole price structure settles down to low levels. For this reason, the Commonwealth Arbitration Court was obliged in 1930 to reduce the basic wage by 10 per cent.

Because wage determination is always on an industry-wide basis, it is felt that the whole pay pattern has settled down to the level of the least efficient employer. At one time a comprehensive attempt was made by a Royal Commission to ascertain specifically what the actual income requirements of a family were according to "reasonable standards of comfort." It was found impossible to carry out the recommendations of the commission because the suggested minimum pay rates were far in excess of what most employers were able to pay.

Is Management Right To Engage in Research?

CHARLES E. WILSON, President, General Electric Company, speaking before the General Electric X-Ray Corporation

Our company—and this applies to almost every private corporation—operates under an obligation to its communities, and its employees, and its stockholders, to produce efficiently and at a fair profit. Have we then, or has any company, the right to undertake research programs, of admitted importance and benefit to the general public, if by so doing we are likely to jeopardize the efficiency of our normal operations and endanger our ability to make that fair profit, even to a small degree? Have we the legal right, and have we the moral right?

Certainly, we have that right, and management is the trustee for all these interests who must recognize and uphold that right, because, in addition to its familiar and already-stated obligations, all business operates in the last analysis at the pleasure of the public.

This is the paramount obligation of all. We must be rather careful of our language here, because I definitely do not mean to say that business operates at the pleasure of government, not in this country. Government itself is an agency of the people, and power to regulate and police, but not to dominate. This is occasionally forgotten by servants of the people, who have been too long in office.

Manufacturing Efficiency Increases

The average number of man-hours expended for each unit of product was 3 per cent less in 1945 than in 1939 in the manufacture of selected types of general purpose industrial equipment.

The Department of Labor recently

Tonnage Travels for Less...

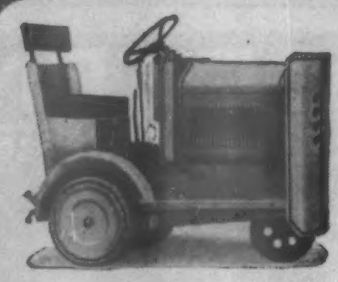
on THE MERCURY "TRACKLESS TRAIN"

Mercury "Tug" electric tractor provides fume-free motive power for train of Mercury "A-310" trailers.

Free of any fixed path—the versatile "Trackless Train" travels wherever material movement dictates—long hauls, short hauls or snaking through congested areas to deliver *more* tonnage at *lower* cost.

Every ton hauled for less because the "Trackless Train" keeps loads on wheels . . . easy to move, no "dead" weight. Moves more tonnage by merely adding more trailers . . . no increase in power units.

Learn how this versatile, low cost material handling system can serve you. For complete information, ask a Mercury Sales Engineer to call. There is no cost or obligation.

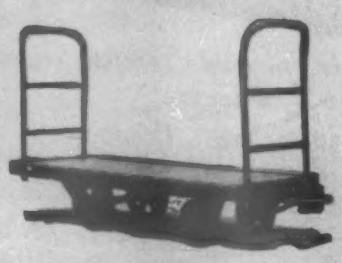


"BANTY" GAS TRACTOR

Smallest gas tractor made—yet develops a drawbar pull in excess of 2000 lbs. A favorite throughout industry for its power, stamina and compact size.

"HUSKIE" GAS TRACTOR

This rugged haulage unit is all that its name implies — a powerful, 6-cylinder, 4-wheel tractor—built to haul any wheeled load it might encounter in industry.



TYPE "A-310" TRAILER

Here's the "burden-bearer" of the "Trackless Train"—an all-steel, all-purpose, castor-steer trailer available in wide range of platform and body types. Easy-running, may be instantly coupled or detached.

FREE: New Catalog No. 7-11

Illustrates and describes all Mercury material handling equipment. Request your copy of this new 52 page catalog today. Please use company letterhead.

FORK-TRUCK —"TRACKLESS TRAIN"

When moving materials over 200 feet— do the job faster, at less cost by Fork-Truck-"Trackless Train." In this system, fork-truck loads trailers—tractor hauls trailers to destination-where fork truck speeds unloading.

MERCURY MANUFACTURING CO.

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1. AUTOMATIC control of charging rate.
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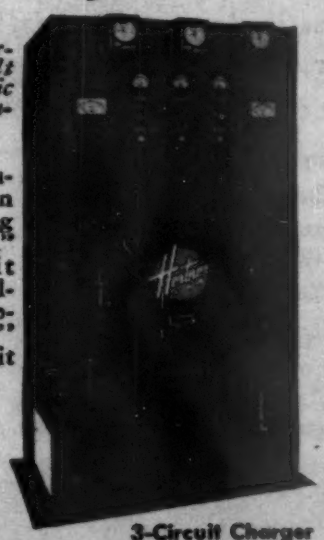
5. OVERLOAD PROTECTION to both motor and generator.

For further information consult your local electric truck representative.

Mail us the coupon for Bulletin 104 describing Hertner Type "K" single-circuit chargers, or Bulletin 108 describing Type "K" multiple-circuit chargers.



3-Circuit Charger Control Panel

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MOTOR-GENERATORS
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A General Precision Equipment Corporation Subsidiary

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announced that between 1939 and 1942 the index of unit man-hour requirements declined steadily to a point 5 per cent below that of 1939, as important gains in manufacturing efficiency were made. However, in 1943 and 1944, the trend was reversed. By 1944, man-hours expended for each unit had increased to about the same level as in the base year, 1939. Average unit man-hour requirements decreased 3 per cent from 1944 to 1945.

Stock Bonus Plan Based on Savings Bonds

General Electric Company has instituted a stock bonus plan. Any employee, other than top officials, may buy up to $10 a week of U. S. Savings Bonds. After five years, G. E. will give the employee company stock equal to market at value to 15 per cent of the Savings Bonds he still holds. In this way the employee's interest on his savings is about 5.4 per cent.

BEHIND THE BYLINE

Facts About *Factory's* Authors

Robert E. Parrett (page 70) started as a foundry employee at the Delco Remy Division of General Motors in 1932. After graduating from the General Motors Institute of Technology as an industrial engineer in 1937, he was transferred to the Saginaw Steering Gear Division, where he worked as tool designer and foreman. At the start of the war he played an important part in developing tooling for machine-gun manufacture. He enlisted as a lieutenant in the Marine Corps in 1943 and served in the Pacific area. After the war he returned to Saginaw as tool engineer, where he was appointed process and plant engineer in 1947.

Carl E. Meyer (page 74) received his B.S. in Architectural Engineering in 1925 from the University of Michigan. He worked for Dick & Bauer, Architects, in Milwaukee and later for the Milwaukee School Board Architectural Department. In 1936 he became

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"Standardized Trucks"

Our experience shows that a truck with 30" x 60" deck is practical for most uses. We have "standardized" six types. Large variety of accessories — shelves, boxes, etc. Also special purpose trucks of steel, stainless and aluminum.

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Precision built. Combines Army Tank durability with modern streamlined beauty.

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Manufacturers of Counting Devices

Want to Start Something?

USE CLARK PUSH BUTTONS

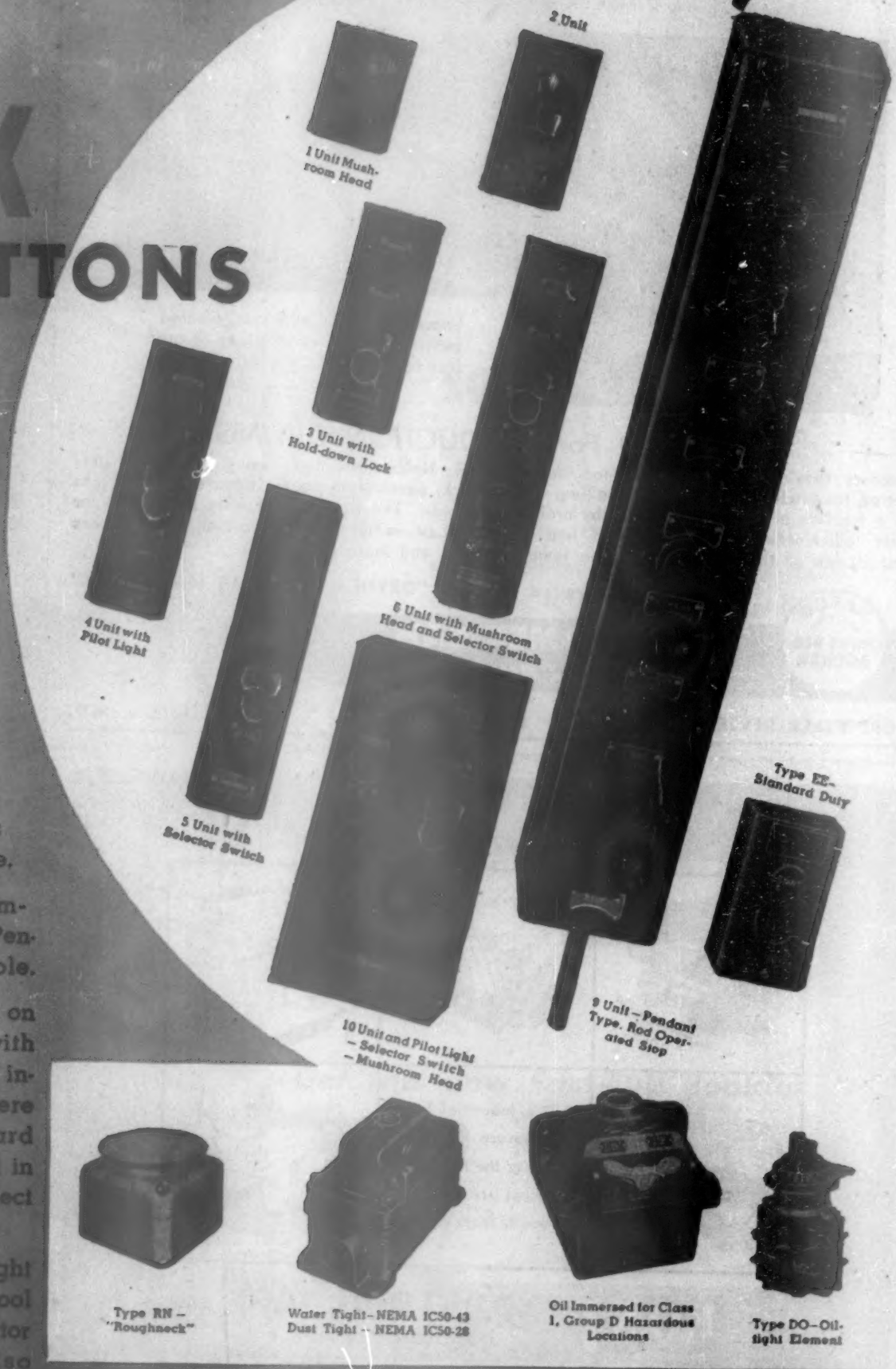
CLARK Type D Push Buttons, featuring silver-to-silver, button-type, double-break contacts, bakelite insulating parts, large electrical clearances, and plenty of wiring space, provide low maintenance and long life in heavy duty operations. Push button stop is independent of contacts. 1½" and 2¼" mushroom heads are available.

Type RN—the "ROUGHNECK"—has mushroom head, cast metal enclosure with rounded shoulders sturdy enough to take rough usage.

Watertight, dust tight, and oil-immersed types can be supplied. Pendant Stations are also available.

Type EE Push Buttons are for use on ordinary starter applications with contactors or starters up to and including NEMA Size 4, 150 Ampere Size. Available only in standard pressed steel enclosures, finished in Machine Tool Gray, and not subject to modifications.

Type DO is a Heavy Duty Oil Tight Element for mounting in machine tool applications . . . Oil Tight Selector Switches and Pilot Lights also available.


2 Unit
1 Unit Mushroom Head
3 Unit with Hold-down Lock
4 Unit with Pilot Light
6 Unit with Mushroom Head and Selector Switch
5 Unit with Selector Switch
10 Unit and Pilot Light – Selector Switch – Mushroom Head
9 Unit – Pendant Type, Rod Operated Stop
Type EE–Standard Duty
Type RN – "Roughneck"
Water Tight–NEMA 1C50-43
Dust Tight – NEMA 1C50-28
Oil Immersed for Class 1, Group D Hazardous Locations
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For every industrial application there's a CLARK Push Button Station available. Write for Bulletin 100.

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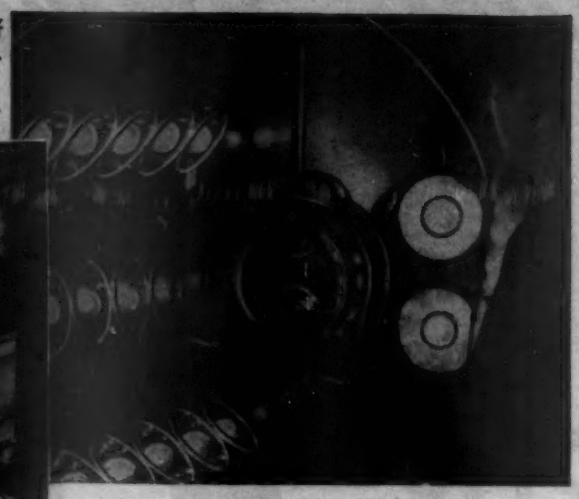
Left*, armature and, right, field of electric motor being dried by infra-red.

Patented by Sterling Varnish Co.



Lamps available in inside silvered (self-reflecting) and clear glass (for reflectors).

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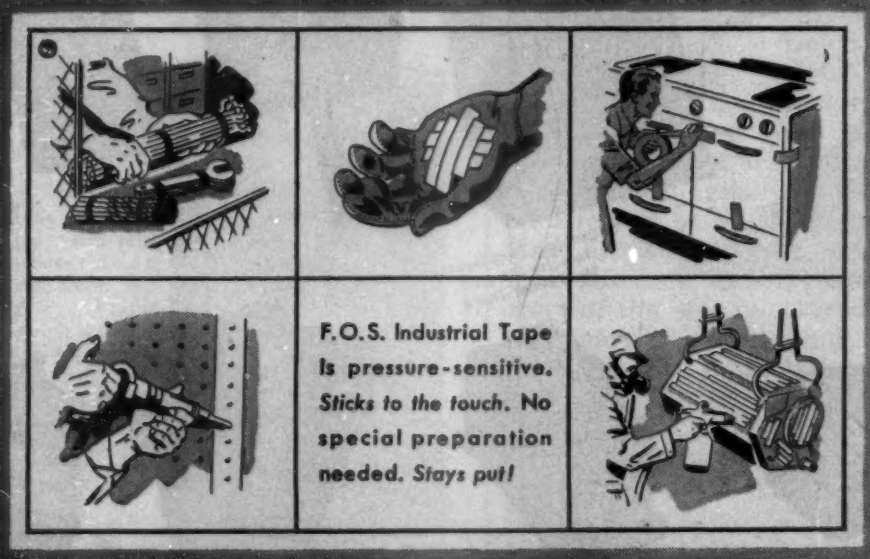
Because they're especially made for industrial use, Nalco Infra-Red Lamps are widely preferred for production drying and baking. Their quick, penetrating heat assures completed jobs in a fraction of the time required by ordinary methods. The flexibility of infra-red makes for easy, quick changes in production line set-ups. Low initial and replacement cost makes installation of this production-proven lamp practical and more economical.

Write for illustrated bulletin: "DRYING PROBLEMS MADE EASY"

NALCO INFRA-RED DRITHERM

NORTH AMERICAN *Electric Lamp Co.*

1047 TYLER STREET ST. LOUIS 6, MO.



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REDUCE PRODUCTION COSTS—F.O.S. Tape is handy, versatile, inexpensive. Simplifies production in *many* ways . . . Stays put—but can be removed quickly without requiring "cleanup." Let SEAMLESS analysts show you how to save time and money with F.O.S. No obligation! . . . *Write today for samples and prices.*

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SEAMLESS REG. U. S. PAT. OFF.

INDUSTRIAL TAPE DIVISION
THE SEAMLESS RUBBER COMPANY
NEW HAVEN 3, CONN., U.S.A.

BEHIND THE BYLINE *(continued)*

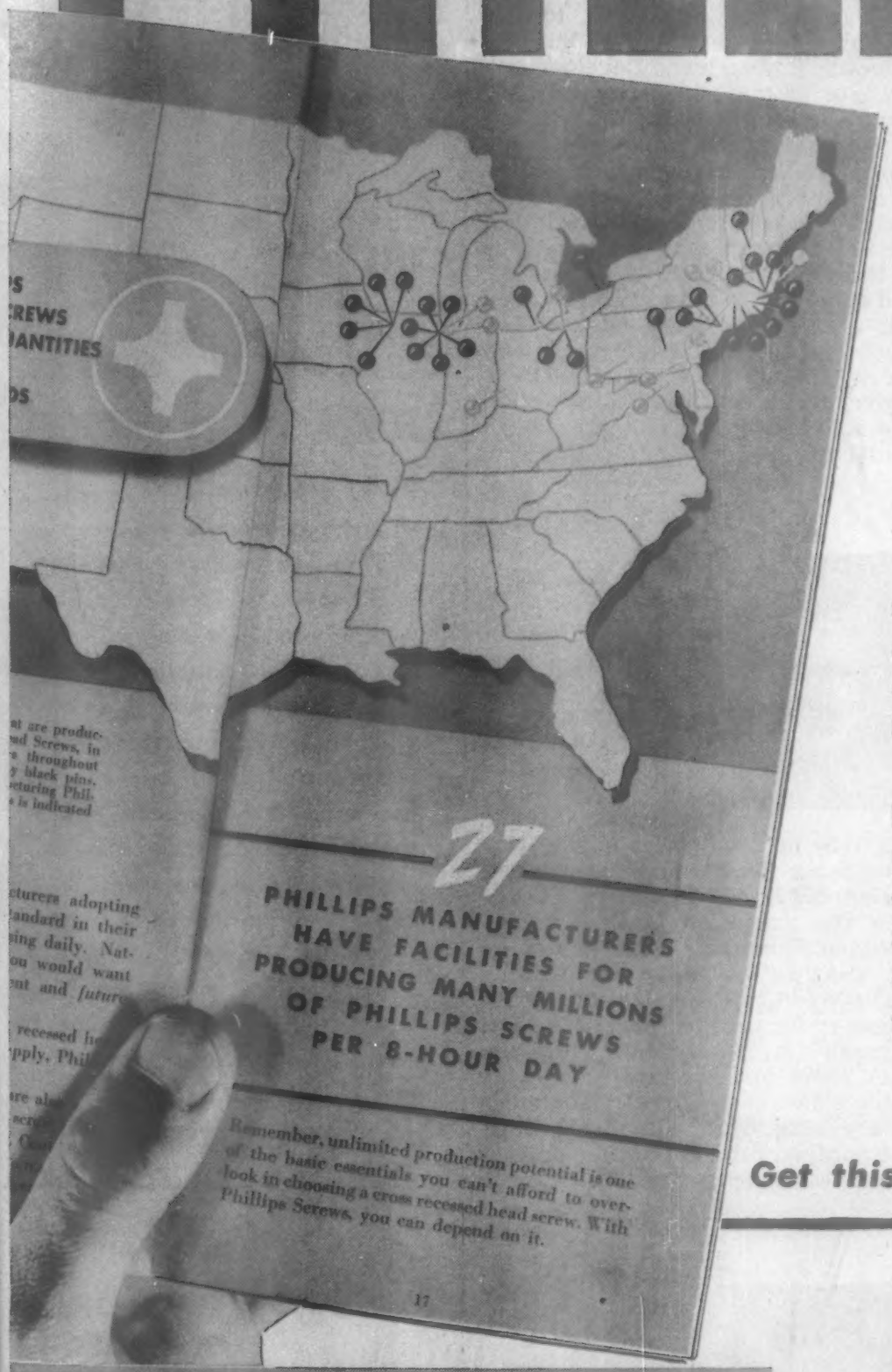
affiliated with Allis-Chalmers in its Department of Buildings and Properties, of which he is now the manager. He is a member of the American Institute of Architects.

John S. Leslie (page 82) is a graduate of Cornell University with an M.E. degree. He is also a graduate of Babson Institute of Business Administration. In 1936 he joined the Leslie Organization. He is also a member of the ASME, and Society of Naval Engineers. In addition, he is an associate member of the Society of Naval Architects and Marine Engineers and he serves as director of the National Council of Industrial Management Clubs.

Raymond K. Hovel (page 87) is time study supervisor at Shartle Brothers Machine Company, Division of the Black-Clawson Company, Middletown, Ohio. Originally planning to teach European languages (he received his B.A. at Miami University in 1935), he studied for a year in France on a French government scholarship. He then went to the University of Cincinnati on a teaching fellowship, and received his M.A. there in 1937. He joined Shartle Brothers the following July, to help install an incentive program. After a 2-year course in industrial engineering with the Methods Engineering Council, he was placed in charge of all incentives, timekeeping, production control, and cost accounting. He is a member of ASTE, and enjoys as hobbies music, reading, writing, and home movies.

Don F. Copell (page 90) was born in Switzerland, where he served a 4-year apprenticeship in mechanical engineering and received a degree in Mechanical and Administrative Engi-

ONLY PHILLIPS RECESSED HEAD SCREWS


27
PHILLIPS MANUFACTURERS HAVE FACILITIES FOR PRODUCING MANY MILLIONS OF PHILLIPS SCREWS PER 8-HOUR DAY
Remember, unlimited production potential is one of the basic essentials you can't afford to overlook in choosing a cross recessed head screw. With Phillips Screws, you can depend on it.
17

are available from MULTIPLE sources of supply

With the cross recessed head screw rapidly becoming the preferred screw for all types of industrial assemblies, it is all-important to be sure that present and future needs can be supplied.

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Elco Tool & Screw Corp.
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New England Screw Co.
Parker-Kalon Corporation
Pawtucket Screw Co.
Pheoli Manufacturing Co.
Reading Screw Co.
Rockford Screw Products Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
Seaboard Screw Corp.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
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Sterling Bolt Co.
Stronghold Screw Products, Inc.
Wales-Beech Corp.
Wolverine Bolt Company

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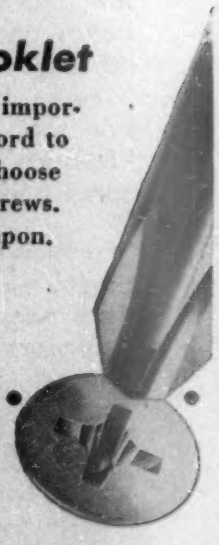
that lets you in on the important facts you can't afford to overlook when you choose cross recessed head screws. It's FREE. Use the coupon.



F-35

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neering in 1927. Since 1937 he has been chief engineer in charge of engineering research, maintenance, training, and personnel work at Wagner Baking Corporation. During the war he acted as consultant to General MacArthur and was sent to the Southwest Pacific by the Office of Scientific Research and Development. He is a past president of the New Jersey Society for the Advancement of Management, is editor of *Modern Management*, a member of the executive committee of the American Society of Bakery Engineers, technical advisor to the educational committee of the American Institute of Baking, and author of many technical articles. For a number of years he has been teaching Industrial Engineering and Work Simplification at New York University and Rutgers University, and is the recipient of the Gilbreth Medal for 1947.

C. M. Highstrete (page 104) started his career as cadet engineer with Grand Rapids Gas Light Company in 1927. His B.S. in mechanical engineering provided a background for work in design and layout of plant rehabilitation and expansion for the Muskegon Gas Company, and from there he went to the American Seating Company in 1936. He was made plant engineer for this firm in 1942, saw it through conversion to war work and back again to peacetime production. He is a member of the Grand Rapids Engineering Club, and his hobbies are hunting, fishing, bowling, and his home workshop.

Harold F. Falk (page 112), vice-president and works manager of The Falk Corporation, has been active in the manufacturing phase of the company for the past 15 years. After his graduation from the University of Wisconsin in 1933, he began work in the plant's shops and laboratories. In 1934 he organized the Falk welding department which now is one of the large contract weldries in the Middle West. In 1940 he was appointed general superintendent of

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Best materials are used throughout for rugged, long-life operation, by the manufacturer awarded the only gold medal for the safety of jacks by the American Museum of Safety.

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BEHIND THE BYLINE *(continued)*

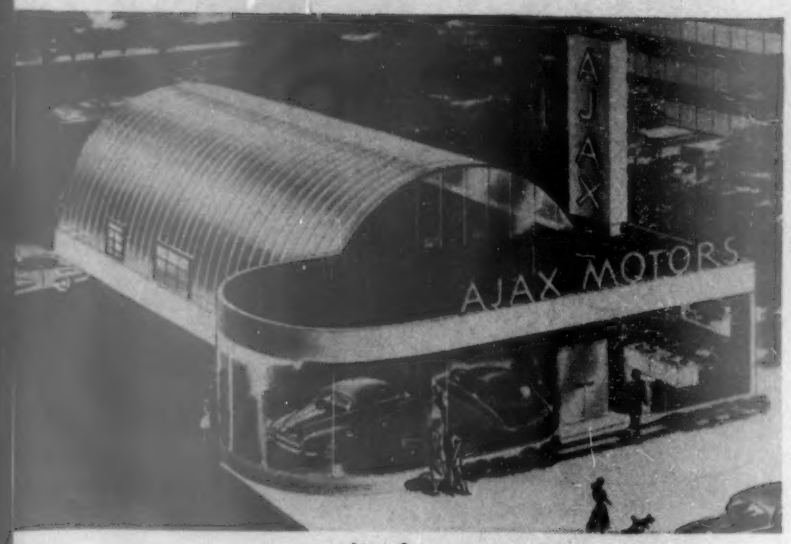
the plant and a director of the corporation. A few years later, he became works manager. He assumed his present position as vice president in 1947. Falk is a director of the Heil Company of Milwaukee and a member of the Society of Naval Architects and Marine Engineers.

Walter Jensen (page 118) has been associated with the ladies' foundation - garment industry for 21 years. He has worked in every phase of corset making, from pattern grading and cutting to the actual manufacture of the finished product in the sewing room. For the past 6 years he has been associated with the Charis Corporation, Allentown, Pa., as factory supervisor, in charge of the 400 or more employees in all sewing room departments.

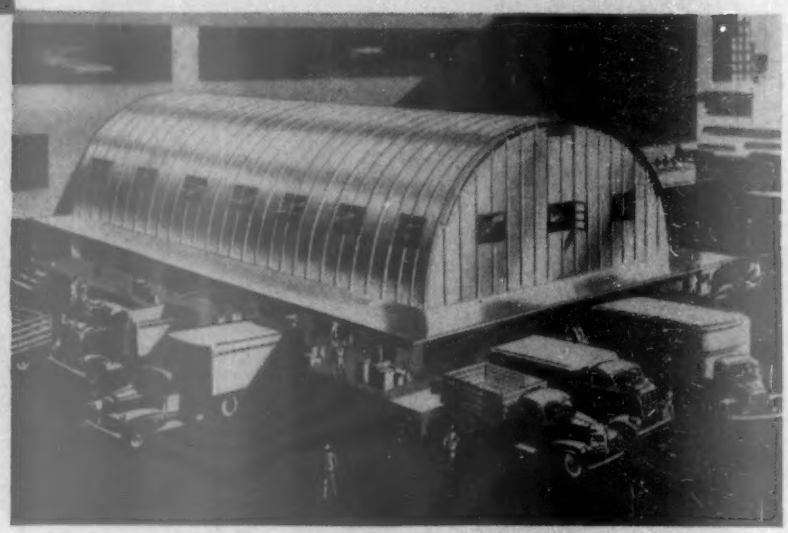
A Byline biography for John R. Morrill (page 120) appeared in the January issue on page 244 at the time his article, "How to Handle and Take Care of D. C. Arc Welders", appeared. He is assistant to the vice president at the Lincoln Electric Company, and directs its School of Arc Welding, which has trained over 20,000 welders in the past 25 years.

Albert M. Sargent (page 124), president and general manager of the Pioneer Engineering & Manufacturing Company and of the Pioneer Pump Company, has spent the major portion of his life working with machines and tools. During his high-school years he worked in a brass and aluminum foundry. He was employed in various New England shops during World War I. In 1919 he moved to Detroit and learned mass production methods from assembly line to the front office while working in the automobile industry there. Came the depression, he realized the need for economies in manufacturing processes, and formed Pioneer Engineering to help work them out in a diversity of industries. Sargent is charter member and past national president of ASTE, and a lifetime member of the American Ordnance Association.

garage, repair shop



store, display rooms



loading dock, etc., etc.

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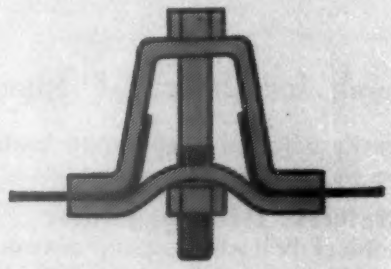

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Water Coolers

BOOKS

Conference on Labor

EMANUEL STEIN, Editor, Proceedings of the N. Y. University First Annual Conference on Labor. Matthew Bender & Co., Inc., 109 State St., Albany 1. 639 pages. Table of statutory references, index. $7.50.

Subtitled "Issues in Collective Bargaining and Taft-Hartley Act." Eighteen articles by people actively engaged in labor relations, some on the management and others the labor side of the bargaining table, comprise this volume. Some of the chapters concern labor arbitration, some various aspects of the Taft-Hartley Act itself, others discuss health and welfare funds, social security, job evaluation, incentive wages, the definition of the proper area of collective bargaining, and the determinants of wage policy.

Business, Legal, and Ethical Phases of Engineering

D. T. CANFIELD and **J. H. BOWMAN,** Professors of Electrical Engineering, Purdue University. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 358 pages. Tables, graphs, sketches, figures; appendixes A, B, C; index. $4.50.

A combination of revisions of two previous books, "Business Administration for Engineers," and "Legal and Ethical Phases of Engineering," by the same two authors. Intended to acquaint engineers with the business, legal, and ethical situations they are likely to encounter in practice. Examples and problems from the fields of chemical, civil, mechanical, and electrical engineering follow each chapter, together with a listing of further reference material.

Economic Problems of Modern Life

S. HOWARD PATTERSON and **KARL W. H. SCHOLZ,** Professors of Economics, Wharton School of Finance and Commerce, University of Pennsylvania. Youth edition. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 782 pages. Tables, charts, questions on text, listing of further topics for investigation, references, index. $4.75.

Because of the economic changes during the past decade, a complete rewriting of material covered in the original book has been necessary, with the addition of new charts based on recent data, new discussions and analyses. Emphasis has been placed on the permanent aspects of the trends rather than on

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innovations resulting from the war. The first half is concerned with the problems of business, while the second part is devoted to social economics, problems of capitalistic organization, labor, national welfare, and international programs. A chapter on the Soviet economy also is included.

Electrical Measurements in Theory and Application

ARTHUR WHITMORE SMITH, Professor of Physics, University of Michigan. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 4th edition. 371 pages. Photographs, drawings, diagrams, formulas, tables, graphs, index. $4.25.

An explanation of the present improved methods in the electrical field are included in this new fourth edition. The meter-kilogram-second system has been used for the definitions of the units of the electrical and magnetic quantities which is said to simplify the approach to them. Methods for measurement of capacitance and inductance are also discussed.

What Every Foreman Should Know

FRED G. CLARK and **RICHARD STANTON RIMANOCZY.** The American Economic Foundation, 285 Madison Ave., New York 17. 17 pages. 75¢.

An explanation of the American Economic Foundation's interpretation of economic facts. Such questions as how the corporation pay envelope fits into the economic machinery, why stockholders invest money in industry, and the $64 question, what is income, are some of the topics discussed. The book is primarily directed at the foreman, so that he may pass along the information to those who work under his supervision.

The Taft-Hartley Act After One Year

The Bureau of National Affairs, 1231 24th St., N.W., Washington 7, D.C. 30 pages. Appendixes A through F, topical index $5.

Subtitled "How the Act Has Operated, How It Is Being Interpreted, How It Affects Collective Bargaining." Book is divided into two parts—"The Act in Operation," and "How the Act Has Been Interpreted." Other topics include a checklist of state laws regulating union security; directories of NLRB offices and personnel, and of the Federal Mediation and Conciliation Service; full text of new NLRB rules and

#11 BLANCHARD SURFACE GRINDER

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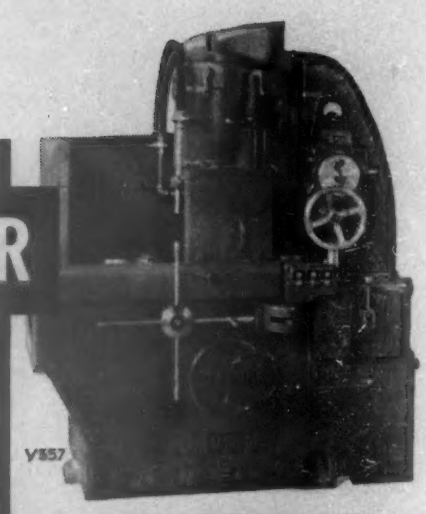

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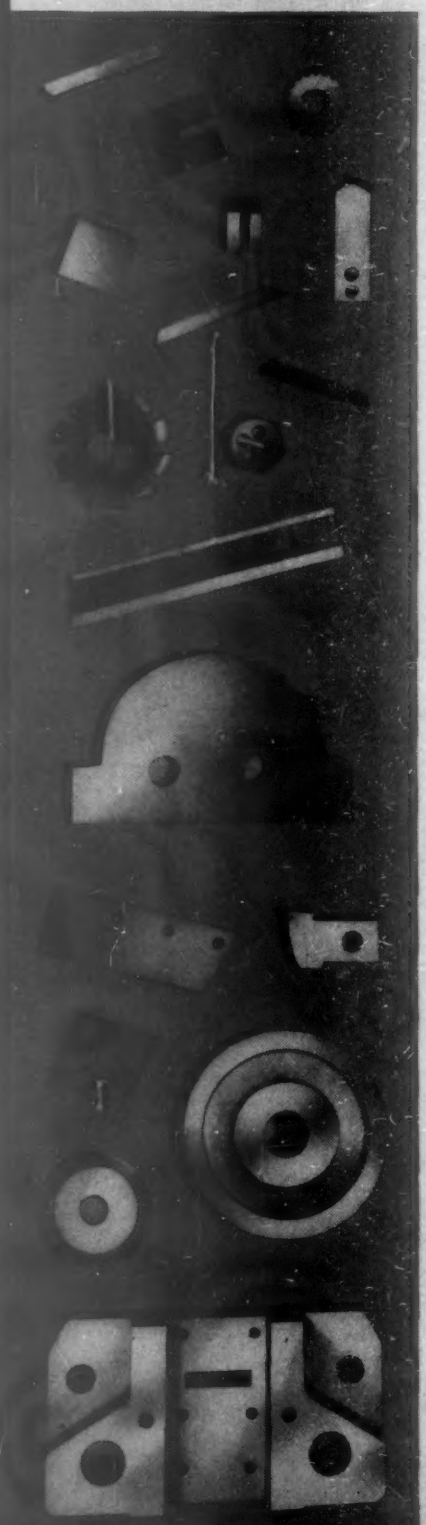

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